WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

75-MM HOWITZER MATÉRIEL

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ORDNANCE MAINTENANCE

75-MM HOWITZER MATÉRIEL

Prepared under direction of the
Chief of Ordnance

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SECTION I

GENERAL

1. **Purpose.**—The purpose of this manual is to furnish suitable instructions for the inspection and maintenance and shop repair of the 75-mm pack howitzer, and carriage, M1, and 75-mm pack howitzer, M1A1, and howitzer carriages, M2, M3, and M3A1. They are for use of ordnance maintenance companies, civilian employees of the Ordnance Department, Reserve officers, National Guard, and Reserve Officers Training Corps students, charged with the maintenance and repair of the matériel.

2. **Scope.**—This manual contains instructions for inspection, disassembly and assembly, and maintenance and repair, supplementary to those instructions covered in TM 9–320 and TM 9–1100. It also describes and prescribes the use of special repair tools.

3. **References.**—The appendix lists references to other publications relating to the matériel covered herein.

SECTION II

INSTRUCTIONS FOR INSPECTION

4. **General.**—Inspection is for the purpose of determining the condition of the matériel, whether repairs or adjustments are required, and the remedies necessary to insure that the matériel is in such

serviceable condition that it will function properly. A record of all inspection and maintenance will be kept in the Artillery Gun Book, O.O. Form 5825. Instructions for the use of the gun book are outlined in its introductory pages. See also OFSB 4–1.

5. Inspection of bore.—*a.* The estimated average accuracy life in full service rounds of the 75-mm pack howitzers, M1 and M1A1, is 12,000 rounds. The howitzers in service shall be star gaged at approximately 10 percent and 90 percent of their estimated average accuracy life in rounds fired, and thereafter at 10 percent during the remainder of their service. Also, they should be star gaged at any time an inspector may deem it necessary on account of doubtful condition, or when the bore shows signs of unusual wear or other irregularities. Decoppering of the bores of cannon before star gaging is prohibited. When star gaging the 75-mm howitzer, M1, or 75-mm howitzer, M1A1, the greatest distance from the muzzle at which star gage measurements are to be made is 35.75 inches.

b. For pastilles or other defects of the bore of the howitzer which require plaster of paris or gutta-percha impressions for measuring purposes, plaster of paris should be used if practicable as it gives a harder surface than gutta-percha and a more accurate measurement is obtained.

c. When a howitzer is to be stored for an extended period of time or to be shipped a long distance, especially if the voyage is over water, the bore should be coated with rust preventive as prescribed in SNL K–1. For ordinary protection, care must be taken to insure that the bore is coated with light lubricating oil, SAE 10–W, for temperatures less than 32° F, and SAE 20–W, for temperatures greater than 32° F.

6. Inspection of howitzer and carriage.—The inspection of the howitzer and carriage and instructions for inspection and verification of sighting and fire-control equipment as outlined in TM 9–320 should be followed. The following additional inspection of the carriage and recoil mechanism should be observed:

a. The recoil mechanism should be inspected for oil leakage, pressure of compressed nitrogen, friction of various packings, serviceability of the oil index, and condition of the cradle ways.

b. To test the reliability of the oil index (fig. 13), insert the oil release, B103913 (fig. 6), in the oil filling and drain valve hole located on the right side near the front end of the recoil cylinder and drain the reserve oil. The oil index should start to move in before the oil ceases to flow and should recede within the oil index follower when the reserve is exhausted. Refill the mechanism as outlined in

TM 9–320, paragraph 62*e*(1) and (2). The oil index should start to move out after about five revolutions of the oil screw filler screw.

c. The proper "full oil reserve" in this system is an amount equal to one-half screw fillerful in excess of the quantity that can be forced into the system without being ejected when the oil release is screwed into the filling and drain hole. With the system filled, any slight amount of reserve oil forced past the recoil cylinder filling valve, A19763 (fig. 15), will force the floating piston against the established pressure, thereby building pressure on the oil side of the system to the extent of the nitrogen pressure present in the recuperator system. The forcing of additional charges of reserve oil into the system to increase the nitrogen pressure *definitely is prohibited.*

d. Remove the recoil cylinder rear head, B17563 (fig. 12). If clear oil is present, it indicates a leak past the recoil piston. Remove screw, BCDX2AA (fig. 14), and disk, A15869, and tighten the piston head, A15872, *slightly.* Wipe the cylinder dry and note whether oil continues to seep past the piston. In this case it is an indication that the recoil piston packing is faulty, and the mechanism should be sent to a base shop for repair.

e. Examine the face of the oil index follower, A135611 (fig. 13), for indication of oil leakage. If a leak is present, tighten slightly on the follower, using great care not to bind the oil index. If leakage continues, renew the oil index packing.

f. Examine the seat between the recoil and recuperator cylinders entering the yoke assembly. If an oil leak is present, the mechanism should be sent to base shop for repair.

g. Examine the guides of the bottom sleigh for burs or scoring.

h. Assemble the bottom sleigh, howitzer, and top sleigh of the carriage. Note that the bottom sleigh slides freely and without excessive side play of 1 mil (0.050) in the cradle. Note that the howitzer sets into its seat without binding and that the top sleigh locks the howitzer in position without strain.

i. Elevate the howitzer through its arc on either the pack howitzer carriage, M1, or the howitzer carriages, M2A1, M3, and M3A1, to see that the operation is smooth and the balance of the howitzer is being controlled by the equilibrator. Rotate the traversing handwheel through the entire angle of traverse on the howitzer carriages, M2A1, M3, and M3A1, to see that the operation is smooth. If the backlash of the elevating crank (fig. 17) or the elevating or traversing handwheel (fig. 8 or fig. 9) exceeds one-eighth of a turn, it should be corrected by adjusting the bearing retainer, B103539 (fig. 8) or B106970 (fig. 9). Examine the rocker (fig. 16) or elevating arc (fig. 7) for burs or scored teeth.

j. Examine the top and bottom carriage of M2A1, M3, and M3A1, for flaws in welded components.

k. Examine the barrel of the equilibrators for rough or scored walls.

l. Examine the trails of the pack howitzer carriage, M1, and howitzer carriages, M2A1, M3, and M3A1, and see that all implement fastenings are in good condition. Examine all trail fastenings and traveling lock connection brackets for broken welds. Examine trail hinge pins and see that they are being lubricated properly.

7. Manometer test.—In order that an intelligent and consistent inspection may be made of the recoil mechanism, it is essential that the inspector be informed not only as to its action but also with regard to certain of its technical peculiarities with which he will come in contact. Therefore, examination for excessive oil leakage past the packing of the recoil piston, recoil piston rod stuffing box, oil index, and filling and drain valve should be made. Normally, a slight leakage of discolored oil past the packing of the recoil piston and the recoil piston rod stuffing box is in evidence. The slight leakage past these two packings insures lubrication.

a. General tests.—(1) The "oil reserve" or "reserve oil" are terms applied to that portion of the oil which normally separates the floating piston from the regulator. Referring to sectioned view (fig. 12), it will be apparent that the compressed nitrogen acts to put pressure on the oil only so long as there is oil between the regulator and the floating piston. After these components come in contact, further movement of the floating piston is prevented and consequently the pressure of the oil will drop to zero. In amount, the reserve oil represents a volume corresponding to a movement of the floating piston of about $\frac{3}{8}$ inch or exactly the same as the travel of the oil index between its extremes of movement.

(2) In determining the nitrogen pressure, the inspector is actually measuring the pressure on the oil transmitted to it by the compressed gas through the medium of the floating piston.

(3) The oil, in passing from the vicinity of the pressure gage to the vicinity of the floating piston, or vice versa, must pass through very small orifices. Because of the resistance offered in these orifices, if the recoil piston jack is operated rapidly in either direction, a misleading pressure will be generated in the vicinity of the gage and registered thereon. For this reason the recoil piston jack screw must be operated at not over four turns per minute.

(4) The oil within the mechanism becomes sluggish at a low temperature. Its action through the small orifices is, therefore, erratic

and the reliability of the gas pressure measurements under such conditions is always doubtful. Therefore, if pressures must be taken in cold weather, it is necessary that the recoil mechanism and extra oil be in a room warmed to at least 50° F. for 24 hours preceding the test.

(5) Since the amount of gas originally placed in the mechanism cannot increase, the pressure at any given temperature cannot become higher except by moving the floating piston forward so as to reduce the volume of the gas chamber. This can be accomplished if an excess of oil is introduced, as may be the case if the oil index is stuck and the sticking is not noticed. Make sure the oil index is registering properly by draining off some of the reserve oil and then restoring it. The oil index will move in when the oil is drained and should move out as the reserve is reestablished. Failure of the oil index is almost invariably on the outward movement.

(6) If gas leaks past the floating piston, it may be detected by the foamy appearance and the sputtering of the oil when draining off the reserve oil.

(7) Place the bottom sleigh (recoil mechanism) in a horizontal position. Remove the filling and drain plug located in the yoke and connect the oil release, B103913 (fig. 6). As the oil release is screwed in, the reserve oil is released and should be caught in a suitable receptacle. The reserve oil should be allowed to flow until the flow of oil practically ceases. The oil index should move inward beyond the face of the oil index follower.

(8) Place the thermometer in the reserve oil drained from the mechanism and make a record of the temperature. Keep the thermometer out of the sun. This should represent as accurately as possible the temperature inside the recoil mechanism.

(9) Attach the adapter of the pressure gage to the oil release at (2) and recoil cylinder filling plug, A18495, at (4) (fig. 6). The gage should be turned to a convenient position for reading. Make all joints tight except joint (4) which should be slightly loose for the purpose of "purging" (removing all air from the line). Purge the line by forcing piston to the rear by means of the jack (about two turns of the handle) and tighten connection (4).

b. To determine gas pressure of mechanism and friction of floating piston.—(1) Remove screw, BCAX1AC, from the recoil cylinder and unscrew recoil cylinder rear head, B17563 (fig. 12), assemble cap (8) (fig. 6) of the recoil piston screw jack, B102874, firmly against the recoil cylinder with the nut (7) tightened. Move the recoil piston to the rear by means of the recoil piston screw jack until a

pressure of approximately 1,250 pounds per square inch is registered on the pressure gage.

(2) Turn the screw of the jack 10 complete revolutions and, while slowly making the tenth revolution, read the pressure gage, tapping the gage lightly to overcome the effect of friction in the gage itself. This gage reading represents the gas pressure plus the friction of the floating piston ($AP + F$). (Make a note of the gage reading.)

(3) Continue turning the jack screw five more revolutions, then reverse the direction of the jack screw, unscrewing for five revolutions, moving slowly on the fifth revolution, and read the gage the second time. This reading represents the gas pressure minus the friction of the floating piston ($AP-F$). (Make a note of the gage reading.)

(4) The gas pressure in the mechanism is one-half the sum of the high and low readings.

$$AP=\frac{(AP+F)+(AP-F)}{2}$$

Example:

Atmospheric temperature, 70° F.
Gage reading, (2) above—1,435 pounds per square inch.
Gage reading, (3) above—1,065 pounds per square inch.
Add these gage readings together—2,500.
Divide the answer by 2—1,250.
1,250 pounds per square inch is the gas pressure of the mechanism.

(5) It must be remembered that it is the sliding friction of the floating piston and not the standing friction that is to be deducted. Therefore, the floating piston must be in motion when a reading is taken on the pressure gage.

c. To correct pressure for temperature variation.—(Volume of air chamber remains constant. With the gun in battery, the pressure varies directly as the "absolute" temperature.) Recoil mechanisms are charged with nitrogen gas at a pressure ranging from 1,250 to 1,265 pounds per square inch at 70° F. temperature (reserve oil off).

(1) To make corrections in pressure, due to change in temperature, the following formula may be used:

$$\frac{P_1}{P_2}=\frac{T_1}{T_2}$$ (volume remaining constant.)

Where, P_1=initial pounds per square inch absolute pressure.
P_2=final pounds per square inch absolute pressure.
T_1=initial absolute temperature.

T_2=final absolute temperature.

Pounds per square inch absolute=gage pressure+14.7.

Absolute temperature=degrees F.+460.

(2) Since atmospheric pressure is small compared to the high pressures in the recoil cylinder, gage pressures may be substituted for absolute pressures in this formula without appreciable error. Substituting the initial conditions (P_1=1,250 pounds per square inch and T_1=70+460=530°F.) gives the following formula:

$$P_t = (460+t) \times 2.36$$

Where, P_t=gage pressure in pounds per square inch at t°F.

t=temperature, ° F., of the oil (and recoil mechanism).

Example.—What is the pressure at 85° F. when the mechanism was originally charged to 1,250 pounds per square inch at 70° F.?

t=85°.

$P_t = (460+85) \times 2.36 = 1{,}285$ pounds per square inch.

(3) The correct pressure at various temperatures may be found by referring to the table below. It will be noted that for each °F. change in temperature there is a corresponding change of approximately 2.36 pounds per square inch in pressure.

Temperature ° F.	Pressure (pounds per square inch)	Temperature ° F.	Pressure (pounds per square inch)	Temperature ° F.	Pressure (pounds per square inch)
−5	1,073	45	1,191	95	1,309
0	1,085	50	1,203	100	1,321
5	1,097	55	1,215	105	1,333
10	1,108	60	1,226	110	1,344
15	1,120	65	1,238	115	1,356
20	1,132	70	1,250	120	1,368
25	1,144	75	1,262	125	1,380
30	1,156	80	1,274	130	1,392
35	1,168	85	1,285	135	1,403
40	1,179	90	1,297	140	1,415

NOTE.—The recoil mechanism is considered serviceable with a variation of plus or minus 50 pounds per square inch. If not within these limits, the condition of the recoil mechanism must be reported to the Chief of Ordnance.

d. To determine friction of floating piston.—(1) The difference between the first reading ($AP+F$), b(2) above, and the second reading ($AP-F$), b(3) above, represents double the friction of the floating piston.

$$F = \frac{(AP+F)-(AP-F)}{2}$$

Example:

Gage reading, *b*(2) above—1,435 pounds per square inch.

Gage reading, *b*(3) above—1,065 pounds per square inch.

Subtract the second gage reading from the first gage reading. The result is 370 pounds per square inch or double the friction of the floating piston. Divide 370 by 2 and the result is 185 pounds per square inch, which is the friction of the floating piston.

NOTE.—The operation of determining the friction of the floating piston should be repeated until uniform results are obtained.

(2) The friction of the floating piston and the friction of the recoil piston and recoil piston rod stuffing box in mechanisms that have been assembled for considerable periods of time will increase to a high friction owing to the absorption of oil by the packings. The normal pressure to overcome the friction of the floating piston is 185 pounds per square inch. The friction of the floating piston may vary between the limits of 150 and 250 pounds per square inch. If not within these limits, the condition of the recoil mechanism must be reported to the Chief of Ordnance.

e. To determine friction of recoil piston and recoil piston rod stuffing box.—(1) Withdraw reserve oil as outlined in *a*(7) above.

(2) Assemble recoil piston screw jack, B102874 (fig. 6), to mechanism as outlined in *b*(1) above.

(3) Force the recoil piston to the rear (about 2 inches) by means of the screw jack, permitting the oil to escape through the oil release, B103913 (fig. 6). Do not remove jack.

(4) Attach pressure gage to oil release as outlined in *a*(9) above.

(5) Force the recoil piston to the rear by means of the screw jack until the gage shows 1,200 to 1,500 pounds per square inch pressure.

(6) Reverse the motion of the jack screw until the jack head leaves the piston. The piston follows the jack until the friction developed by the recoil piston and stuffing box packings equals the pressure in the cylinder. Since the oil pressure in the cylinder is greater than that required to overcome the friction, until equalized, the gage hand drops without fluctuating and remains stationary when the piston rod stops moving.

(7) Read the gage. The gage reading at this point represents the sum of the friction of the recoil piston and the friction in the recoil piston rod stuffing box.

(8) Obtain three uniform gage readings.

NOTE.—Exercise the piston by repeating operations given in *e*(5), (6), and (7) a sufficient number of times until the three gage readings are practically uniform. This is important since true friction readings cannot be obtained until the packings are well lubricated.

(9) The normal pressure necessary to overcome the combined friction of the recoil piston and piston rod stuffing box is 500 pounds per square inch. This may vary from 400 to 800 pounds per square inch. Recoil mechanisms having excessively low or high frictions should be reported to the Chief of Ordnance.

8. Inspection of light caisson, M1, and light limber, M2.—The inspection of the light caisson, M1, and light limber, M2, as outlined in TM 9–320 should be followed.

SECTION III

TOOLS FOR INSPECTION

9. General.—The tools for inspection and those pertaining to maintenance and repair are issued as a set of special repair tools and are listed in Standard Nomenclature List No. C–18, sections V and VI.

10. Tools for inspection.—The following tools are used in the inspection of the pack howitzer and carriages by ordnance maintenance companies:

a. Sights, bore.—The bore sights (fig. 20) are used in connection with the verification and adjustment of the panoramic telescopes.

b. Release, oil.—The oil release (fig. 6) is used when necessary to drain the reserve oil from the recoil mechanism.

c. Filler, oil screw, M3, with adapter and handle.—The oil screw filler (fig. 6) is used in replenishing the reserve oil in the recoil mechanism.

d. Jack, screw, recoil piston.—The recoil piston screw jack (fig. 6) is used to force the recoil piston to the rear when making manometer tests.

e. Gage, pressure, 200 kg., with connection.—The pressure gage (fig. 6) is used when making manometer tests to determine the compressed gas pressure and floating piston friction.

f. Target, testing.—The testing target (fig. 21) is used in conjunction with the bore sights in the verification of the panoramic telescopes.

g. Gage, tire.—The tire gage is used in testing air pressure in the tires.

h. Tester, pressure gage.—(1) The pressure gage tester (1) (fig. 5) is used in testing the accuracy of the service pressure gage with the master pressure gage. It is filled with liquid which is subjected

to pressure by a screw at the will of the operator, pressure being transmitted equally to both pressure gages.

(2) To use the pressure gage tester, clamp it in a vise. The tester arms should stand level, the screw withdrawn, and the apparatus filled with recoil liquid before assembling the pressure gage, in order that it may be tested to eliminate possible air bubbles in the connection. The master gage is screwed in one arm and the service gage to be tested in the other arm. Apply pressure by means of the operating screw. If the gages are not in agreement, proceed as outlined in paragraph 25.

(3) Figure 5 shows the pressure gage tester and the following equipment for use therewith:

(*a*) *Adapters.*—The adapters (9) are used to connect the pressure gage to the tester. The adapter (8) is issued with all outfits but is used only with the 155-mm and 240-mm howitzer matériel.

(*b*) *Gage, pressure, master.*—The master pressure gage (5) is used to check the accuracy of the service pressure gage. It is graduated in pounds per square inch as well as kilograms per square centimeter. The master gage should be calibrated annually before the regular inspection period and at any time there is doubt of its accuracy.

(*c*) *Gaskets and glasses.*—The gaskets (6), (7), and (10) and the glasses (11) are spare parts.

(*d*) *Jack, gage hand.*—The gage hand jack (3) is used in removing the pressure gage indicator hand when it is not in agreement with the master gage.

(*e*) *Set, gage hand.*—The gage hand set (4) is used when replacing the pressure gage indicator in agreement with the master pressure gage.

SECTION IV

INSTRUCTIONS FOR MAINTENANCE AND REPAIR

11. General.—Incidents of wear and breakage make it necessary to completely disassemble various parts of the howitzer carriage. Therefore, the following instructions are promulgated to cover disassembly and assembly of the carriage not covered in TM 9–320.

12. Disassembly of axle sleeve and traversing nut (75-mm pack howitzer carriage, M1).—*a.* The axle having been removed from the front trail, release the axle sleeve, C5784 (fig. 18), from the axle by dismounting key, A20722, which projects into the axle keyway, the screws connecting the smaller dust cover outer clip, A15729, and the balls of the traversing nut. To remove the balls, take off the ball cover, A17941, on the hub of the traversing handwheel, turn the handwheel ball passageway down, and work the balls out through the openings. The metal of the axle will have been set slightly over the head of axle arm screw, A20723, locking the right axle arm in place. Chip off the overhand and take out the screw. Hold the axle in a vise protected by wood or leather clamps so as not to damage it and unscrew the right axle arm, C6586, which has a left-hand thread. Slide the axle sleeve and traversing handwheel and allied parts off the axle.

b. The handwheel and nut are secured to the sleeve by the ball bearing cap, B13968 (fig. 18), locked by a countersunk head screw. They are disconnected by removing the locking screw, unscrewing the cap, and sliding the handwheel off the outer race of the ball bearing.

c. Referring to figure 18, it will be seen that balls of the traversing nut form an endless string, and that as the nut is revolved on the axle, the string of balls is constantly passing through the tunnel-like opening closed by the ball cover.

d. If the nut, for any reason, is dismounted from the handwheel, it must be reassembled so that parts of the tunnel match.

e. At either end of the string of balls (fig. 18) in the tunnel are traversing guides, A9226. Any difficulty in operation of the nut will probably be traceable to deformation or wear of the traversing guides. Careful handling of these parts and absolute cleanliness in reassembling is essential. If it becomes necessary to remove the ball bearing, CAAX1AU (A15809), off the sleeve, C5784, straighten the tail of the lock washer and unscrew the ball bearing nut, A15810.

13. Assembly of axle sleeve and traversing nut (75-mm pack howitzer carriage, M1).—*a.* In assembling the parts shown

in figure 18, the cap, B13968, is assembled on the sleeve, C5784, and followed by the ball bearing, A15809. Assemble the lock washer, A15811, and ball bearing lock nut, A15810, and set the nuts tight against the lock washer.

b. Assemble the handwheel over ball bearing, A15809 (fig. 18), and assemble screws, BCKX2BD, which retain the handwheel and cap. Slide the traversing nut into the hub of the handwheel and lock it in position with screws, BCKX2CG.

c. Slide the sleeve, C5784 (fig. 18), on the axle, C1654. Assemble the right axle arm and lock it to the axle with axle arm screw, A20723. Assemble the axle key, A20722, to the sleeve, C5784, with washer and screw, BCCX1AA. Assemble the cover, C1666, to the handwheel with screws, BCKX1DD.

d. Assemble the 71 balls, CCAX1D (fig. 18), through the tunnel, and when the last ball is in its proper position in the tunnel, assemble the ball cover, A17941, securing it with washer, BECX3E, and screw, BCFX2BD.

14. Adjustment of equilibrator (75-mm pack howitzer carriage, M1).—*a.* If the equilibrators prove too strong for easy elevation and depression, depress the rockers and assemble the equilibrator locking tool by screwing it into equilibrator stem plug, A21725 (fig. 19), until the spring of the equilibrator is compressed. Release the equilibrator pin lock, A3552, and screw the equilibrator trunnion pin, A21724 (fig. 19) farther into the equilibrator stem, B19614.

b. A stronger effect is secured by unscrewing the equilibrator trunnion pin, but movement in this direction must be limited to such as will leave sufficient thread on the pin engaged in the stem to withstand the buckling stresses. Not more than 4½ inches of thread should be exposed.

c. When the effort required at the elevating crank to elevate and depress at all points in the elevating range are as nearly equal as possible, assemble the equilibrator pin lock and remove the equilibrator locking tool.

d. It will be noted that the pressure on the equilibrator spring when restrained by the equilibrator locking tool is about 1,450 pounds. Replace the equilibrator spring with caution. The free height of the spring is about 34 inches; consequently, the stem and barrel are separated until the spring has been compressed 7½ inches to a load of about 640 pounds.

15. Dismounting of cradle (75-mm howitzer carriage, M2A1, M3, and M3A1).—*a.* To remove top sleigh, howitzer, and bottom sleigh from the carriage, assemble the equilibrator assembling

bolt (fig. 2) by inserting it through the hole in the equilibrator barrel socket formed on the top carriage and through the equilibrator barrel of each equilibrator until the assembling bolt comes in contact with the equilibrator spring guide tube plug, A140626 (fig. 11). Then screw the assembling bolt into the plug, A140626, and elevate cradle until equilibrator is free.

b. Remove the cradle trunnion pins and lift the cradle free of the carriage.

16. Disassembly of elevating and traversing mechanism (75-mm howitzer carriage, M2A1, M3, and M3A1).—*a.* In the disassembly of parts pertaining to the elevating and traversing mechanism, care must be taken to remove all locking screws before an attempt is made to disassemble any parts of the mechanism which may be covered by paint.

b. In the removal of ball or roller bearings, it should be noted that in most cases the cup of the bearing is a tight fit. Therefore, provision should be made before their withdrawal to have suitable tool equipment to do the work. This equipment is to be designed and made by the ordnance maintenance company.

17. Dismounting top carriage (75-mm howitzer carriage, M2A1, M3, and M3A1).—*a.* Remove the cotter pin, BFAX2AN (fig. 9), and the pintle pin nut, A142519. Remove the pintle pin, C60295, from its bearing being careful that the key of the pintle pin does not score its keyway.

b. Remove the cotter pins in the flexible joint, A138006 (fig. 9). Remove the screws, BCBX1CB, from the traversing gear case and then remove the case. Slide the top carriage to the rear and remove it from its seat on the bottom carriage.

18. Removal of spring carrier (75-mm howitzer carriage, M2A1, M3, and M3A1).—*a. Disassembly of spring carrier of the M3 carriage.*—(1) Place the carriage in firing position. Remove the disk and rim wheel, with tire assembly. Remove the wheel hub assembly, with brake drum and roller bearings. Remove nut, BBHX2A (fig. 10), from the wheel carrier pin. Remove the wheel carrier assembly from its bearing in the bottom carriage.

(2) Remove the six nuts, BBAX1A (fig. 10), from screws, BCKX2CK, in the spring carrier cover. Remove the hexagon nut, BBAX2D, from the spring carrier shaft, B108606, and then remove the shaft and bushing, A140586. Remove the spring carrier from the wheel carrier.

(3) Remove the spring carrier cover assembly and then assemble the spring compressor through the opening for the spring carrier

shaft. Assemble the spring compressor nut and compress the spring carrier compression spring, A140597 (fig. 10), slightly.

(4) Remove the safety set screw in the spring carrier bracket buffer cap, A140600 (fig. 10), from the spring carrier bracket, D7272 or D7273. Unscrew the spring compressor nut until all tension on the spring carrier compression spring is released, then remove the spring compressor and disassemble the parts in the spring carrier bracket.

b. Assembly.—This should be performed in the reverse order of disassembly.

19. Disassembly of brake mechanism.—In order to gain access to the brake assembly of the 75-mm howitzer carriages, M2A1, and M3, it is necessary to remove the disk and rim wheel with tire assembly, hub cap, outer wheel spindle nut, and parts that retain the wheel hub assembly, brake drum, and roller bearing in position. Instructions for the disassembly of the brake mechanism will not be required, due to the simplicity of the design and ease of disassembly and assembly.

20. Special repair tools.—Pressure gages become inaccurate through the accidental movement of the hand upon the spindle and from wear or distortion of the linkage. In using the pressure gage, if pressure is applied or released too suddenly, the hand may strike the stop pin and be moved on the spindle. Repairs consist in pulling of the hand with the gage hand jack and resetting it with the gage hand set in agreement with the master pressure gage when the gages are being tested by the pressure gage tester. Master gages should be returned to an arsenal periodically for verification of their accuracy.

21. Light caisson, M1, and light limber, M2.—Maintenance and adjustment as outlined in TM 9–320 should be followed. No detailed instructions will be given for disassembly or assembly as the design and construction of the vehicle is not complicated.

SECTION V

TOOLS FOR MAINTENANCE AND REPAIR

22. Chest, tool, special repair.—*a.* The special repair tools pertaining to the 75-mm pack howitzer, M1, and M1A1, and 75-mm pack

howitzer carriage, M1, and howitzer carriages, M2A1, M3, and M3A1, are carried in chest, D5433 and chest, D32123, respectively, and listed in Standard Nomenclature List No. C–18. The space occupied by chest, D5435, is 1.508 cubic feet, the dimensions being 20⅝ inches long, 12⅝ inches wide, and 10 inches high. The chest, D32123 (fig. 1), occupies a space of 2⅝ cubic feet, the dimensions being 27⅝ inches long, 12⅝ inches wide, and 12 5/16 inches high.

b. A number of these tools are provided for maintenance, repair, and inspection of this matériel, such as chisels, drifts, files, hammers, pliers, screw drivers, punches, and wrenches, the names or general characteristics of which indicate their uses and application. Therefore, detailed description and methods of use thereof are not outlined herein. Those tools, however, which are of special design and not commonly used are described and their uses outlined below.

23. Tool, driving hub liner.—The purpose of this tool is to facilitate the removal of hub liner from the wheel hub of the pack howitzer carriage, M1. It is a bronze casting, cylindrical in shape, and is 4½ inches long.

24. Bolt, equilibrator, assembly.—The assembly bolt (fig. 2) is 22 inches long, is threaded ½–13NC–2 on one end, and the other end is knurled a distance of 1⅝ inches. The purpose of the bolt is to facilitate the assembly of equilibrator of the howitzer carriages, M2A1, M3, and M3A1, and to retain the equilibrator as an assembled unit when making adjustments or when replacing the equilibrator in its bearing on the carriage.

25. Compressor, spring (for M3 carriages having spring carriers only).—The spring compressor (fig. 3) is composed of a ¾-inch threaded bolt, 12¾ inches over-all, and a ¾-inch special nut. The purpose of the spring compressor is to facilitate the assembly and disassembly of the spring carrier group assembly.

26. Puller, gear (for M2, M3, M3A1 carriages).—The gear puller (fig. 4) consists of a plate and three screws, two of which have nuts. Its purpose is primarily to remove the elevating worm wheel, B109828 (carriages, M3, and M3A1) (fig. 8), and traversing worm wheel, B108549 (all carriages) (fig. 9), from their shafts.

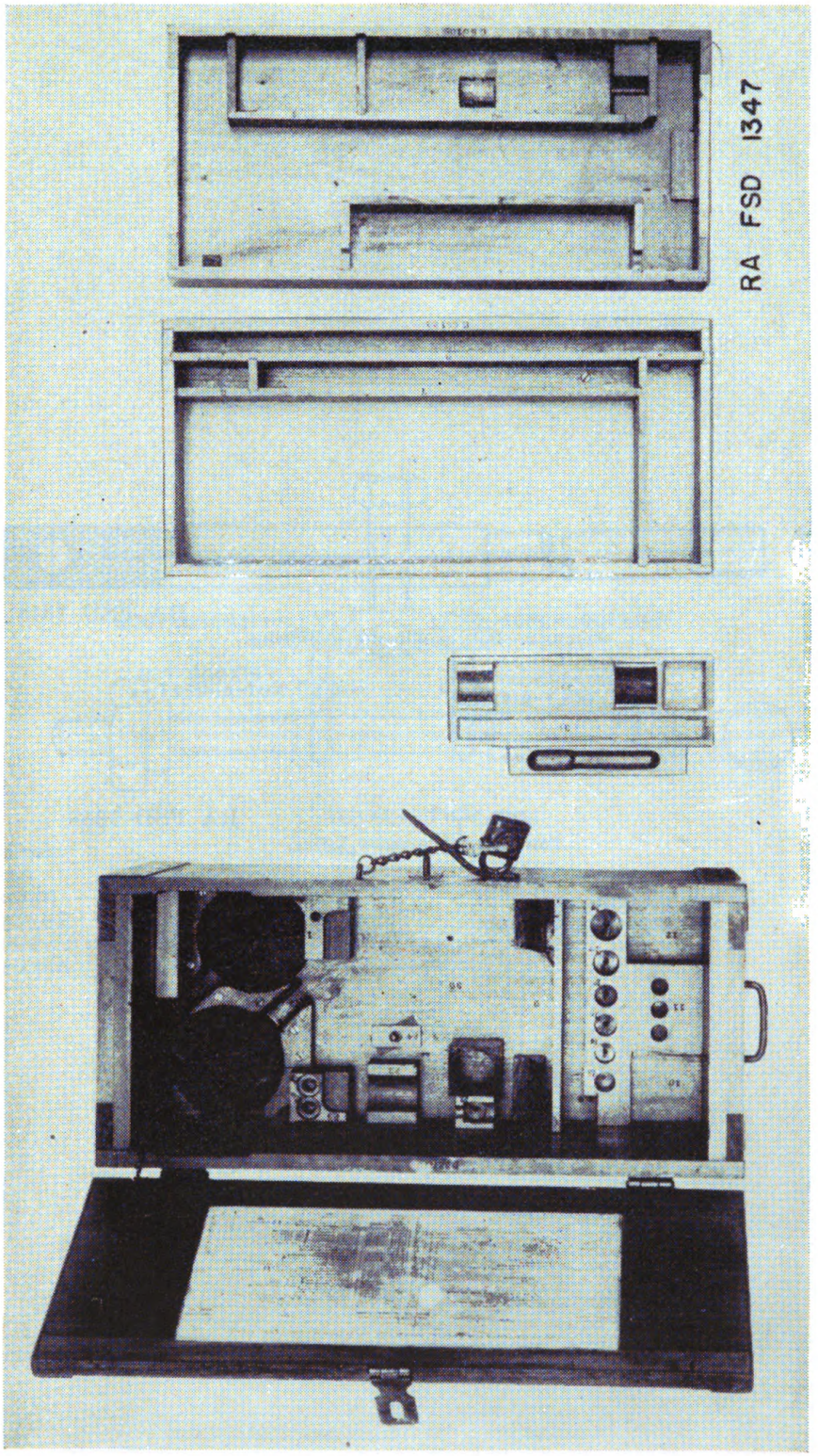

FIGURE 1.—Chest, tool, special repair.

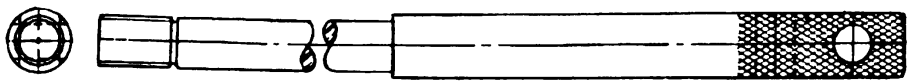

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FIGURE 2.—Bolt, equilibrator, assembling.

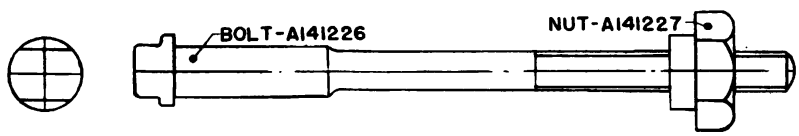

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FIGURE 3.—Compressor, spring.

Reference	*Item*
A141226	Bolt, spring compressor.
A141227	Nut, spring compressor bolt.

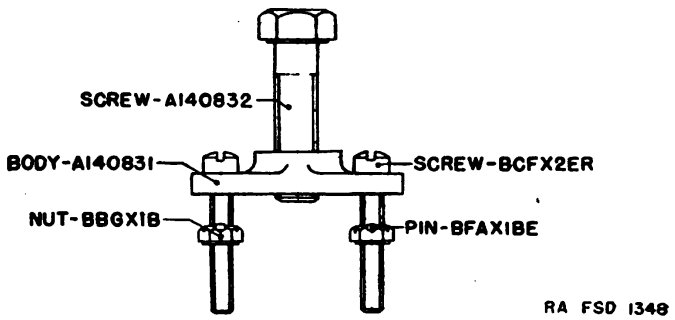


FIGURE 4.—Puller, gear.

Reference	*Item*
A140831	Body, gear puller.
BBGX1B	Nut, slotted, s-fin., 5/16–18NC–2.
BFAX1BE	Pin, cotter, split, S., 1/16 by 3/4.
A140832	Screw, cap, hex-hd., 5/8–11NC–2 by 2 1/4.
BCFX2ER	Screw, mach., oval-fil-hd., S., 5/16–18NC–2 by 2.

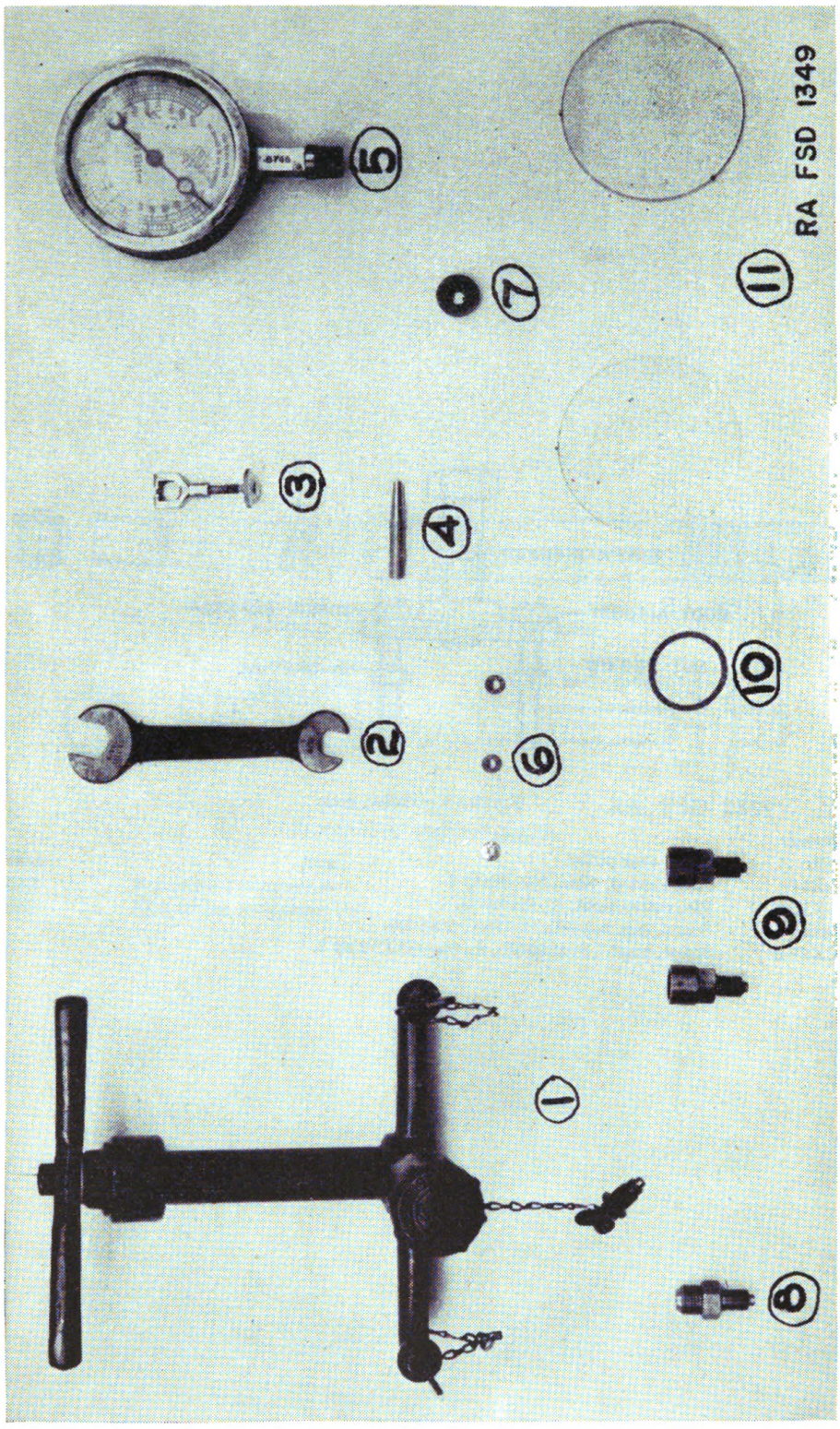


FIGURE 5.—Tools used for testing and repairing pressure gage.

Reference	*Item*
1—24–15–7	Tester, pressure gage.
2—TKKX2H	Wrench, engrs., dble-hd., 5/8–7/8 opngs. (alloy–S.).
3—A442	Jack, gage hand.
4—15–5–511P	Set, gage hand.
5—B748	Gage, pressure, master.
6—24–15–10F	Gaskets, adapter (gage, reservoir and adapter) (spare).
7—24–15–9D	Gasket, piston (spare).
8—24–15–10D	Adapter.[1]
9—24–15–10Q	Adapters.
10—24–15–10L	Gasket, oil reserve (spare).
11—A1715	Glasses, pressure gage (spare).

[1] Furnished with all pressure gage tester outfits but used with the 155-mm and 240-mm howitzer matériel only.

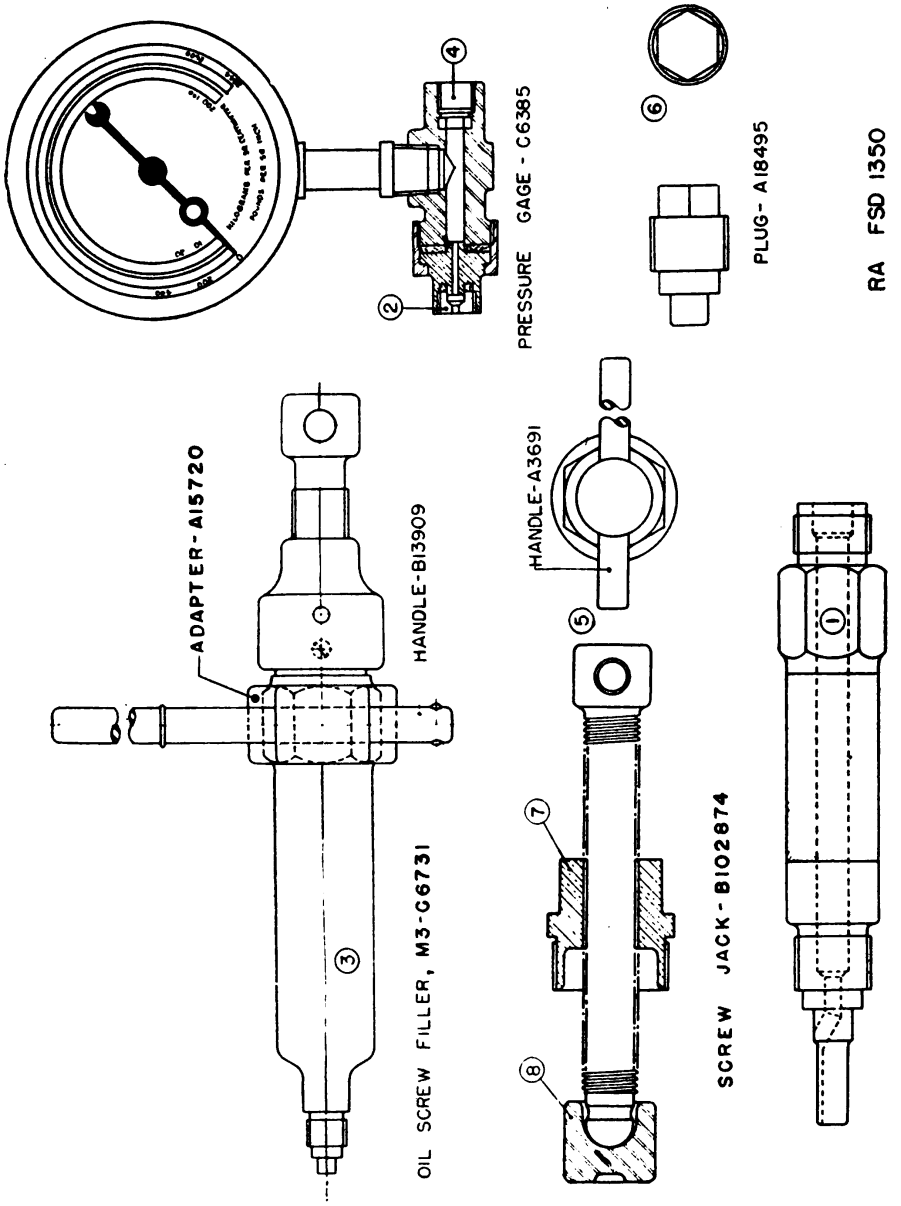


FIGURE 6.—Tools for manometer tests.

Reference	*Item*
A15720	Adapter, oil screw filler, M3, with screw (BCUX2FK)
C6731	Filler, oil screw, M3, with adapter.
C6385	Gage, pressure.
B13909	Handle, assembly.
A3691	Handle.
B102874	Jack, screw, recoil piston.
A18495	Plug, filling, recoil cylinder.
B103913	Release, oil.

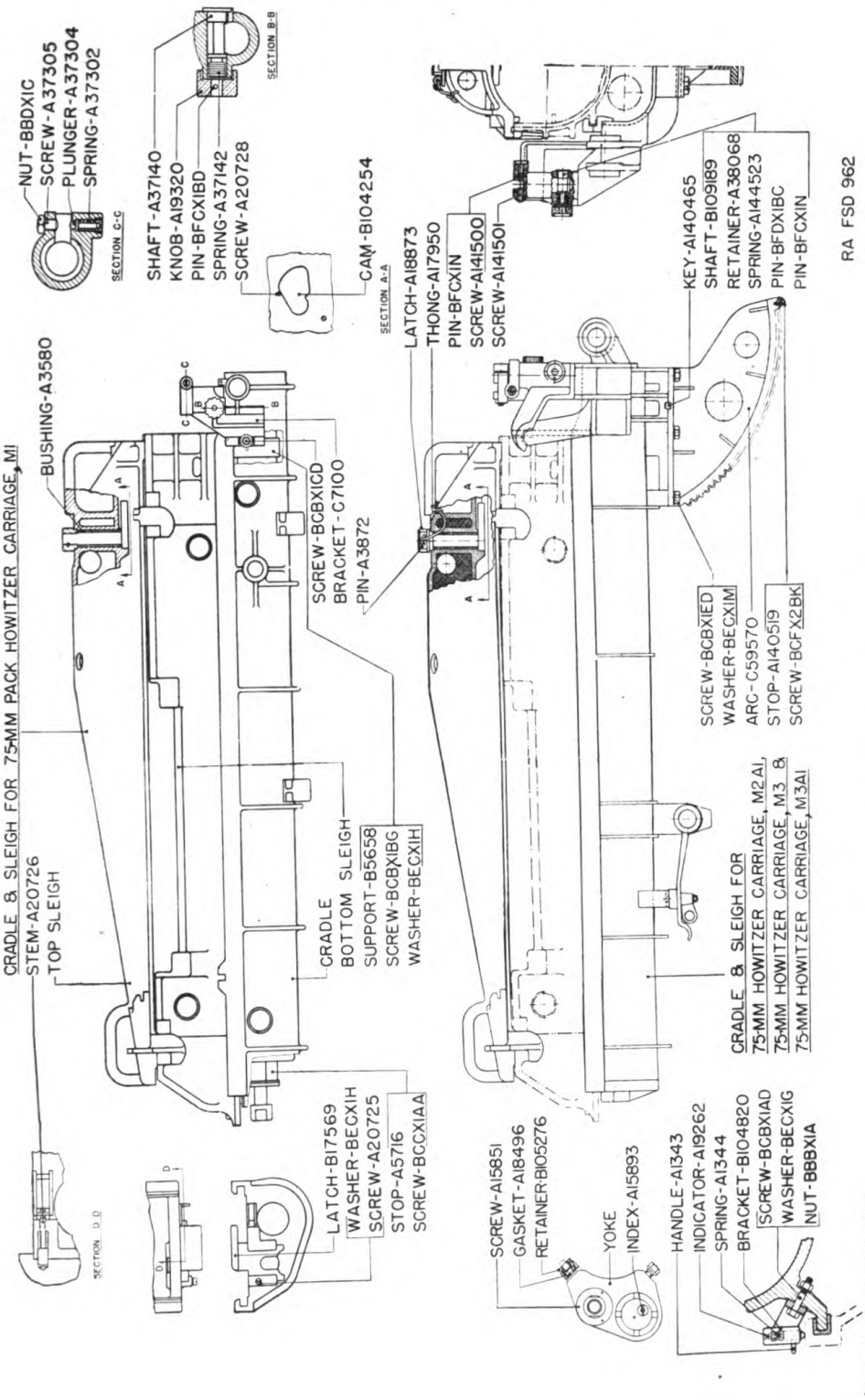


FIGURE 7.—Cradle and top sleigh (left and rear view).

Reference	*Item*
C59570	Arc, elevating, assembly.
B104820	Bracket, recoil indicator.
C7100	Bracket, sight.
A3580	Bushing, cam.
B104254	Cam, top sleigh clamping.
A18496	Gasket, recoil cylinder filling plug.
A1343	Handle, recoil indicator.
A15893	Index, oil.
A19262	Indicator, recoil.
A140465	Key, elevating arc.
A19320	Knob, sight retaining shaft.
A18873	Latch, clamping, top sleigh.
B17569	Latch, piston rod.
BBDX1C	Nut, jam, hex., s-fin., 3/8–24NF–2.
BBBX1A	Nut, reg., hex., s-fin., 1/4–28NF–2.
BFDX1BC	Pin, stght., S., 3/32 by 1/4.
BFCX1N	Pin, taper, No. 4/0 (0.109) by 1.
BFCX1BD	Pin, taper, No. 0 (0.156) by 1 1/4.
A3872	Pin, top sleigh clamping latch.
A?7304	Plunger, sight socket.
B105276	Retainer, recoil cylinder filling plug.
A38068	Retainer, spring.
BCBX1AD	Screw, cap, hex-hd., 1/4–28NF–2 by 1 1/4.
BCBX1BG	Screw, cap, hex-hd., 5/16–24NF–2 by 2.
BCBX1CD	Screw, cap, hex-hd., 3/8–24NF–2 by 1 1/4.
BCBX1ED	Screw, cap, hex-hd., 1/2–20NF–2 by 1 1/4.
BCCX1AA	Screw, cap, oval-fil-hd., 1/4–20NC–2 by 3/4.
A15851	Screw, fl-hd., S., .164–36NF–3 by 1/4.
A20728	Screw, hdls , fl-pt., S., 3/8–24NF–3 by 3/4.
A37305	Screw, hdls., rd-pt., S., 3/8–24NF–3 by 3/4.
A141501	Screw, hdls., rd-pt., S., 3/8–24NF–3 by 7/8.
BCFX2BK	Screw, mach., oval-fil-hd., S., No. 10 (0.190)–24NC–2 by 7/8.
A20725	Screw, piston rod latch.
A141500	Screw, sight clamping.
A37140	Shaft, retaining, sight.
B109189	Shaft, sight retaining.
A1344	Spring, compression, 0.035 diam. stock, .28 O. D., 8 coils.
A37302	Spring, compression, 0.063 diam. stock, .375 O. D., 6 coils.
A144523	Spring, torsion, 0.055 diam. stock, .60 O. D., 13 coils, R. H
A37142	Spring, torsion, 0.062 diam. stock, .62 O. D., 8 1/2–L–coils.
A20726	Stem, piston rod latch.
A140519	Stop, elevating.
A5716	Stop, recoil cylinder.
B5658	Support, cylinder.
A17950	Thong, latigo lea., 3/16 by 9 by 1/8 thick, both ends slit.
BECX1G	Washer, lock, reg., 1/4 by 3/32 by 1/16.
BECX1H	Washer, lock, reg., 5/16 by 1/8 by 1/16.
BECX1M	Washer, lock, reg., 1/2 by 1 1/64 by 1/8.
——	Yoke.

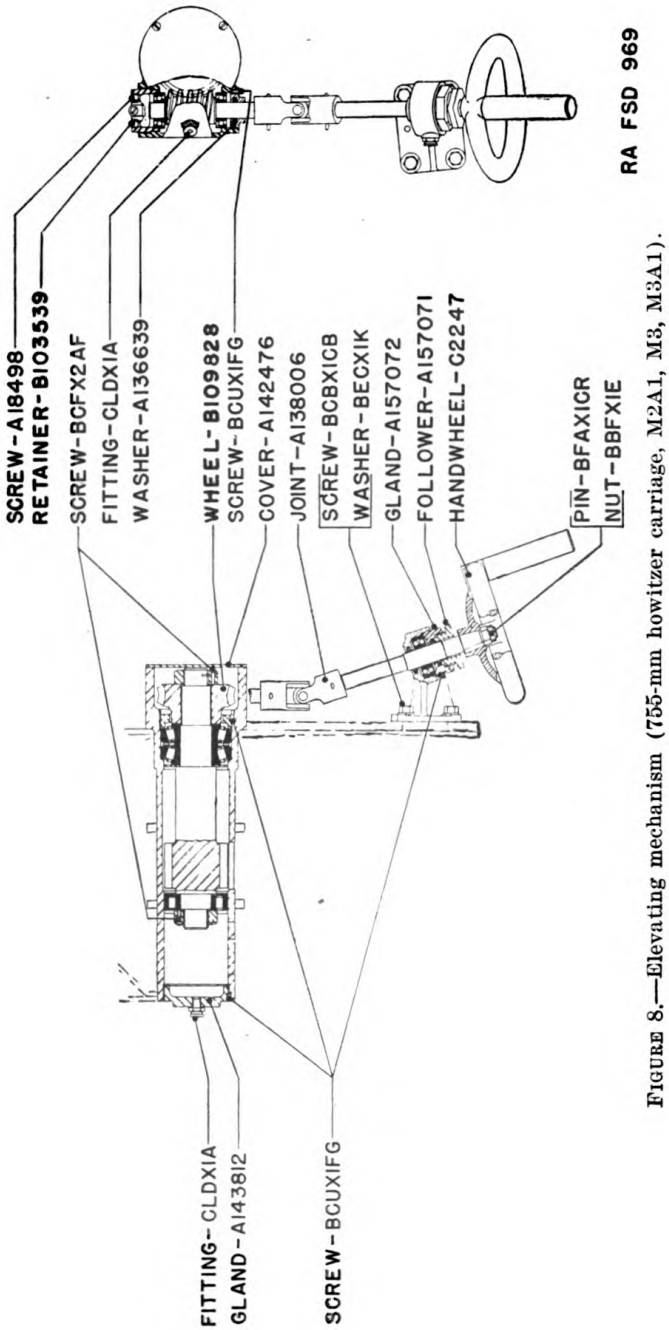


FIGURE 8.—Elevating mechanism (155-mm howitzer carriage, M2A1, M3, M3A1).

Reference	*Item*
A142476	Cover, elevating gear case.
CLDX1A	Fitting, lubr., b-hd. type, stght., ⅛–27NPT, male.
A157071	Follower, packing.
A143812	Gland, elevating gear case.
A157072	Gland, retaining.
C2247	Handwheel, 6.5 in., assembly.
A138006	Joint, flexible.
BBFX1E	Nut, castle, ½–20NF–2.
BFAX1CR	Pin, cotter, split, S., 3/32 by 1¼.
B103539	Retainer, ball bearing.
BCBX1CB	Screw, cap, hex-hd., ⅜–24NF–2 by ⅞.
A18498	Screw, hdls., fl-pt., S., 5/16–24NF–2 by 5/16.
BCFX2AF	Screw, mach., oval-fil-hd., S., No. 8 (0.164)–32NC–2 by ½.
BCUX1FG	Screw, set, hdls., fl-pt., cor-res-S., No. 10 (0.190)–32NF–3 by 5/16.
A136639	Washer, felt, hard, wool, 2 1/32 I. D. by 1⅛ O. D. by 3/16 thick.
BECX1K	Washer, lock, reg., ⅜ by ⅛ by 3/32.
B109828	Wheel, worm, elevating.

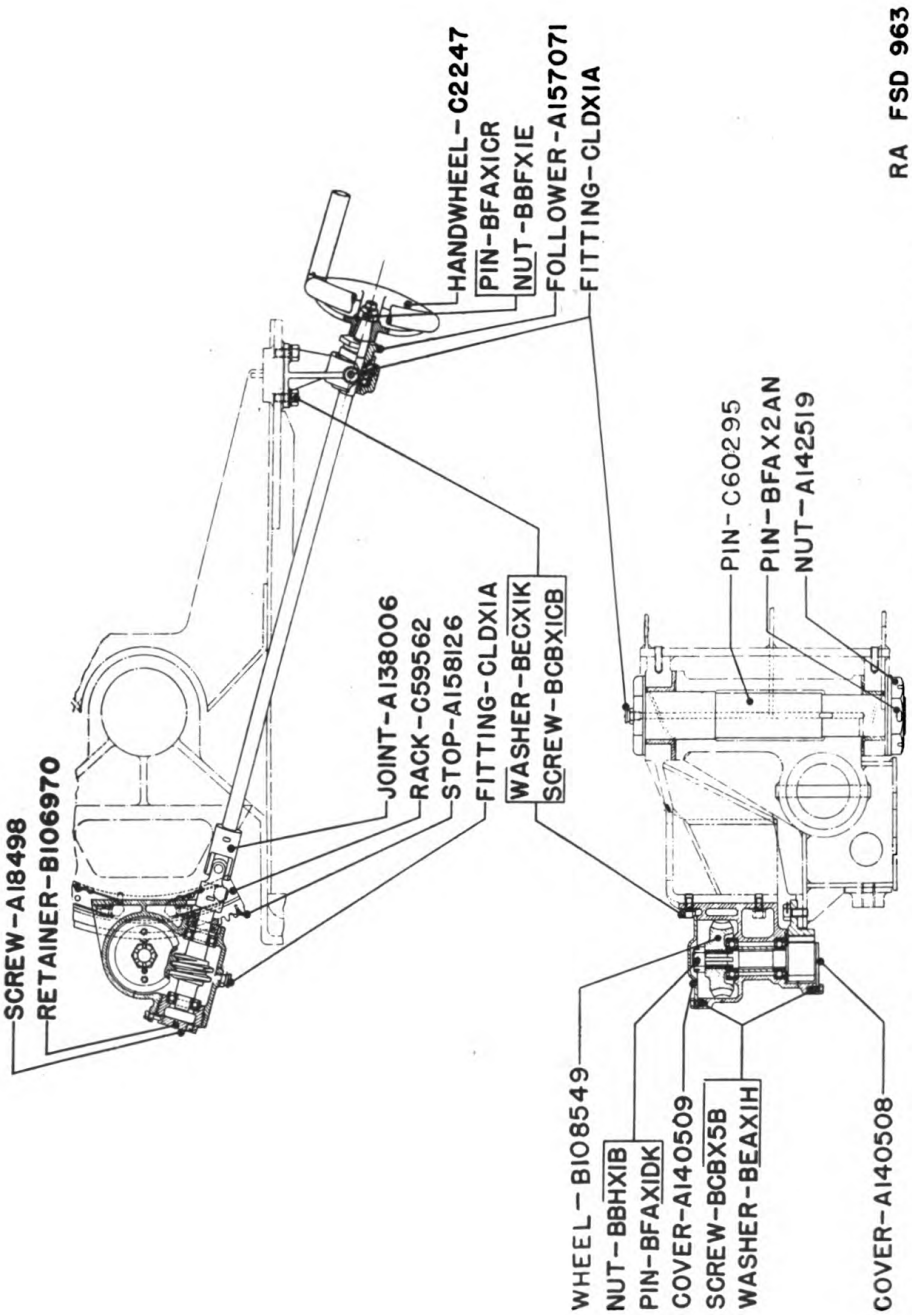


FIGURE 9.—Traversing mechanism (75-mm howitzer carriage, M2A1, M3, M3A1).

Reference	*Item*
A140509	Cover, traversing gear case, large.
A140508	Cover, traversing gear case, small.
CLDX1A	Fitting, lubr., b-hd. type, stght., ⅛–27NPT, male.
A157071	Follower, packing.
C2247	Handwheel, 6.5 in., assembly.
A138006	Joint, flexible.
BBFX1E	Nut, castle, ½–20NF–2.
A142519	Nut, pintle pin.
BBHX1B	Nut, slotted, s-fin., ⅝–18NF–2.
BFAX1CR	Pin, cotter, split, S., 3/32 by 1¼.
BFAX1DK	Pin, cotter, split, S., ⅛ by 1½.
BFAX2AN	Pin, cotter, split, S., 3/16 by 4.
C60295	Pin, pintle.
C59562	Rack, traversing.
B106970	Retainer, ball bearing.
BCBX5B	Screw, cap, hex-hd., ¼–28NF–2 by ½.
BCBX1CB	Screw, cap, hex-hd., ⅜–24NF–2 by ⅞.
A18498	Screw, hdls., fl-pt., S., 5/16–24NF–2 by 5/16.
A158126	Stop, traversing.
BECX1K	Washer, lock, reg., ⅜ by ⅛ by 3/32.
BEAX1H	Washer, lock, "Shakeproof No. 12 type," ¼-in.
B108549	Wheel, worm, traversing.

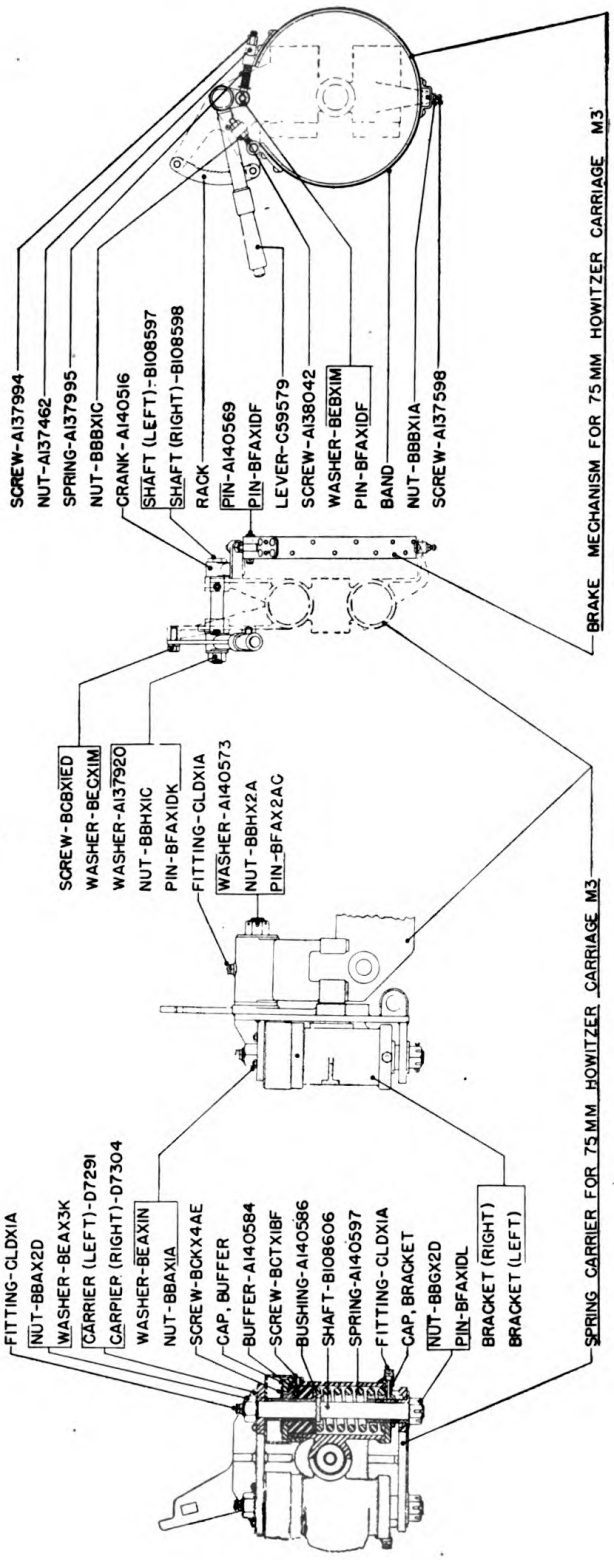


FIGURE 10.—Spring carrier (75-mm howitzer carriage, M3).

Reference	*Item*
——	Band.
D7273	Bracket, left.
D7272	Bracket, right.
A140584	Buffer, spring carrier spring.
A140586	Bushing, spring carrier shaft, upper.
A140600	Cap.
A140588	Cap.
D7291	Carrier, wheel, left, assembly.
D7304	Carrier, wheel, right, assembly.
B141737	Cover, spring carrier, assembly.
A140516	Crank, brake band.
CLDX1A	Fitting, lubr., b-hd. type, stght., ⅛–27NPT, male.
C59579	Lever, hand brake, group assembly.
A137462	Nut, brake band adjusting.
BBAX1A	Nut, reg., hex., s-fin., ¼–20NC–2.
BBBX1A	Nut, reg., hex., s-fin., ¼–28NF–2.
BBBX1C	Nut, reg., hex., s-fin., ⅜–24NF–2.
BBAX2D	Nut, reg., hex., s-fin., ⅞–9NC–2.
BBHX1C	Nut, slotted, s-fin., ¾–16NF–2.
BBGX2D	Nut, slotted, s-fin., ⅞–9NC–2.
BBHX2A	Nut, slotted, s-fin., 1⅛–12NF–2.
BFAX1DF	Pin, cotter, split, S., ⅛ by ⅞.
BFAX1DK	Pin, cotter, split, S., ⅛ by 1½.
BFAX1DL	Pin, cotter, split, S., ⅛ by 1¾.
BFAX2AC	Pin, cotter, split, S., 3/16 by 2¼.
A140569	Pin, rod end, ⅝ in. diam.
B144340	Rack, brake ratchet.
A137994	Screw, adjusting, brake band.
A138042	Screw, brake band anchor.
BCBX1ED	Screw, cap,hex-hd., ½–20NF–2 by 1¼.
A137598	Screw, fil-hd., S., ¼–28NF–2 by ⅞.
BCKX4AE	Screw, mach., fl-hd., br., No. 10 (0.190)–24NC–2 by ½.
BCKX2CK	Screw, mach., fl-hd., S., ¼–20NC–2 by 1.
BCTX2C	Screw, set, socket-hd., rd-pt., alloy-S., ¼–20NC–3 by ½.
B108597	Shaft, brake, left.
B108598	Shaft, brake, right.
B108606	Shaft, spring carrier.
A137995	Spring, compression, .08 diam. stock, 1 1/16 O. D., 15 coils.
A140597	Spring, compression, 1 3/32 diam. stock, 2 13/16 O. D., 8 coils.
A140573	Washer, bz., 1 5/32 I. D. by 2 5/8 O. D. by 0.125 thick.
BECX1M	Washer, lock, reg., ½ by 1 1/64 by ⅛.
BEAX1H	Washer, lock, "Shakeproof No. 12 type," ¼-in.
BEAX3K	Washer, lock, "Shakeproof No. 14 type," ⅞-in.
BEBX1M	Washer, plain, S., ½ (SAE std.).
A137920	Washer, S., 2 5/32 I. D. by 1⅝ O. D. by ⅛ thick.

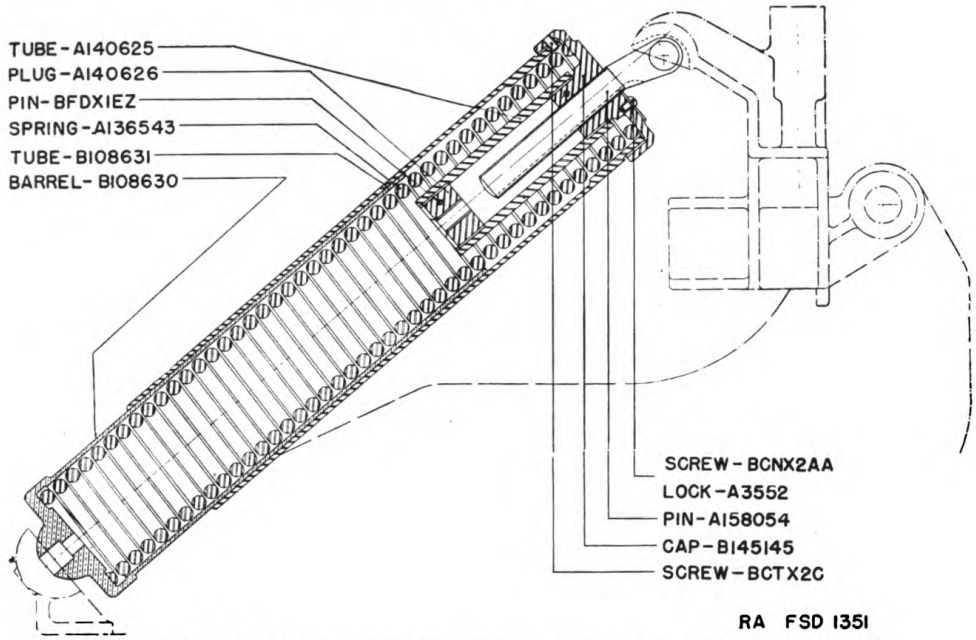


FIGURE 11.—Equilibrator, assembly (75-mm howitzer carriage, M2A1, M3 and M3A1).

Reference	*Item*
B108630	Barrel, equilibrator.
B145145	Cap, equilibrator.
A2552	Lock, equilibrator pin.
A158054	Pin, equilibrator trunnion, bent.
BFDX1EZ	Pin, stght., S., 3/16 by 1¾.
A140626	Plug, equilibrator spring guide tube.
BCNX2AA	Screw, mach., rd-hd., S., No. 10 (0.190)–24NC–2 by ¼.
BCTX2C	Screw, set, socket-hd., rd-pt., alloy-S., ¼–20NC–3 by ½.
A136543	Spring, equilibrator, 7/16 diam. stock, 3 9/16 O. D., 40 coils.
B108631	Tube.
A140625	Tube, equilibrator spring guide.

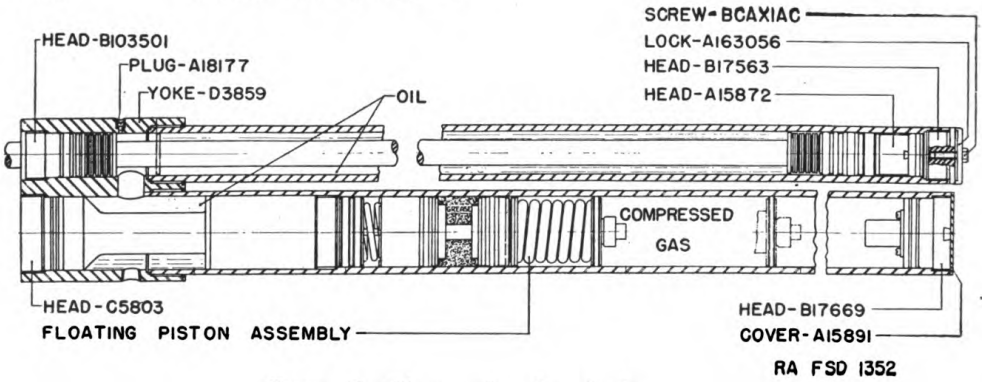


FIGURE 12.—Diagram of recoil mechanism.

Reference	*Item*
A15891	Cover, recuperator cylinder.
C5803	Head.
A15872	Head, piston.
B103501	Head, recoil cylinder, front.
B17563	Head, recoil cylinder, rear.
B17669	Head, recuperator cylinder, rear.
A163056	Lock, recoil cylinder.
A18177	Plug, purge.
BCAX1AC	Screw, cap, hex-hd., ¼–20NC–2 by 1.
D3859	Yoke.

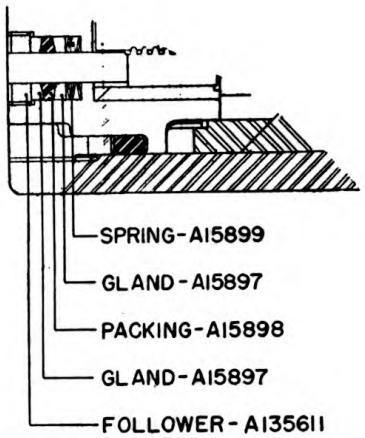


FIGURE 13.—Oil index.

Reference	*Item*
A135611	Follower, oil index.
A15897	Gland, oil index.
A15898	Packing, oil index.
A15899	Spring, Belleville, oil index packing.

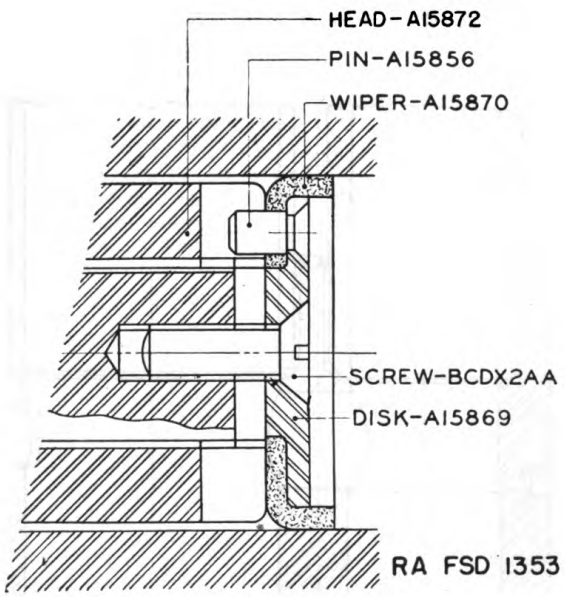


FIGURE 14.—Recoil cylinder wiper.

Reference	*Item*
A15869	Disk.
A15872	Head, piston.
A15856	Pin, recoil piston disk.
BCDX2AA	Screw, cap, fl-hd., ¼-20NC-2 by ¾.
A15870	Wiper, recoil cylinder.

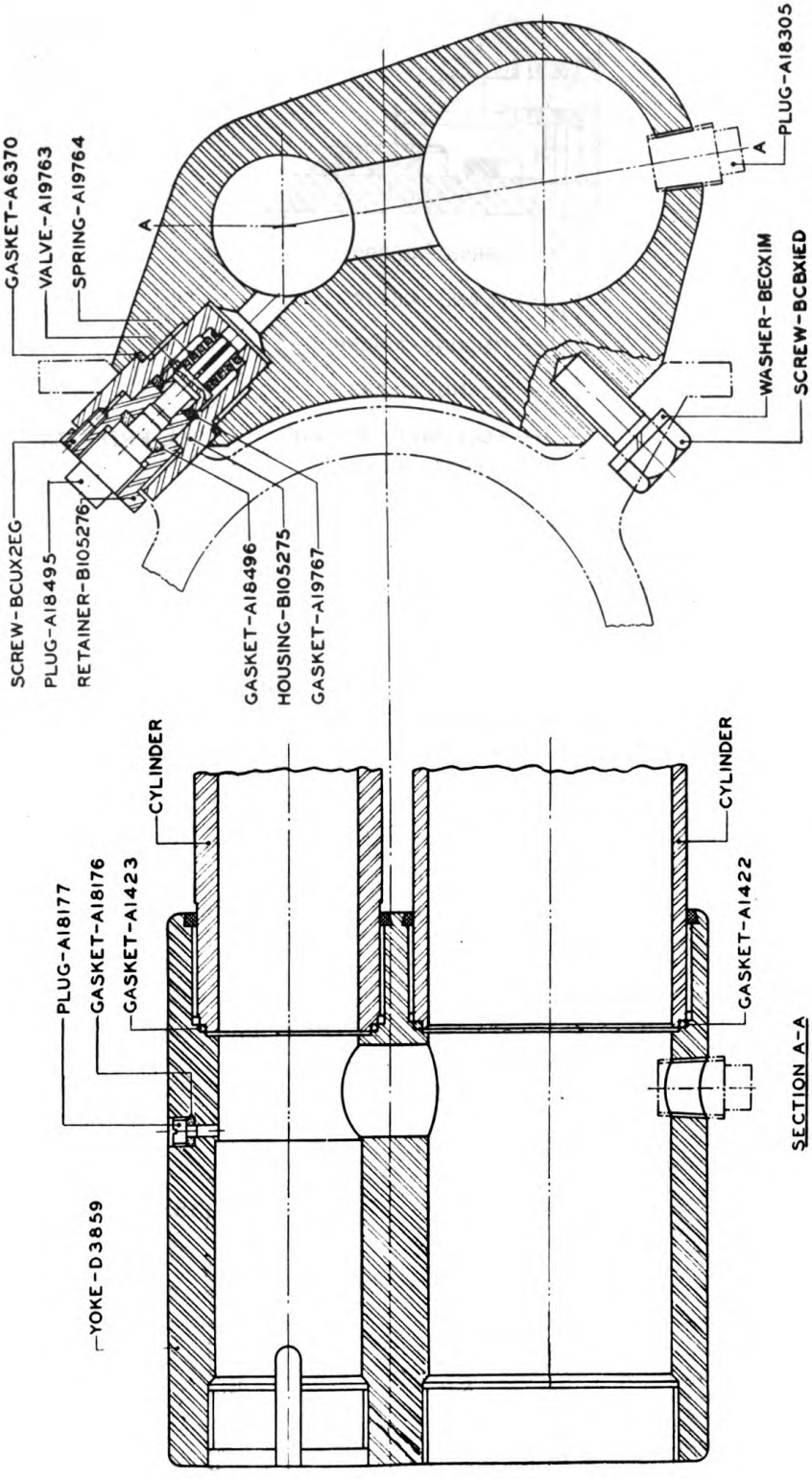


FIGURE 15.—Recoil cylinder filling valve.

Reference	*Item*
A18176	Gasket, purge plug.
A1423	Gasket, recoil cylinder.
A18496	Gasket, recoil cylinder filling plug.
A19767	Gasket, recoil cylinder filling valve.
A6370	Gasket, recoil cylinder filling valve housing.
A1422	Gasket, recuperator cylinder.
B105275	Housing, recoil cylinder filling valve.
A18305	Plug, pipe, S., sq-hd., ⅜-in.
A18496	Plug, filling, recoil cylinder.
A18177	Plug, purge.
B105276	Retainer, recoil cylinder filling plug.
BCBX1ED	Screw, cap, hex-hd., ½–20NF–2 by 1¼.
BCUX2EG	Screw, set, hdls., cone-pt., cor-res-S., No. 6 (0.125)–44NF–3 by ⅜.
A19764	Spring, compression, 0.078 diam. stock, .472 O. D., 6½ coils.
A19763	Valve, filling, recoil cylinder.
BECXIM	Washer, lock, reg., ½ by 1 1/64 by ⅛.
D3859	Yoke.

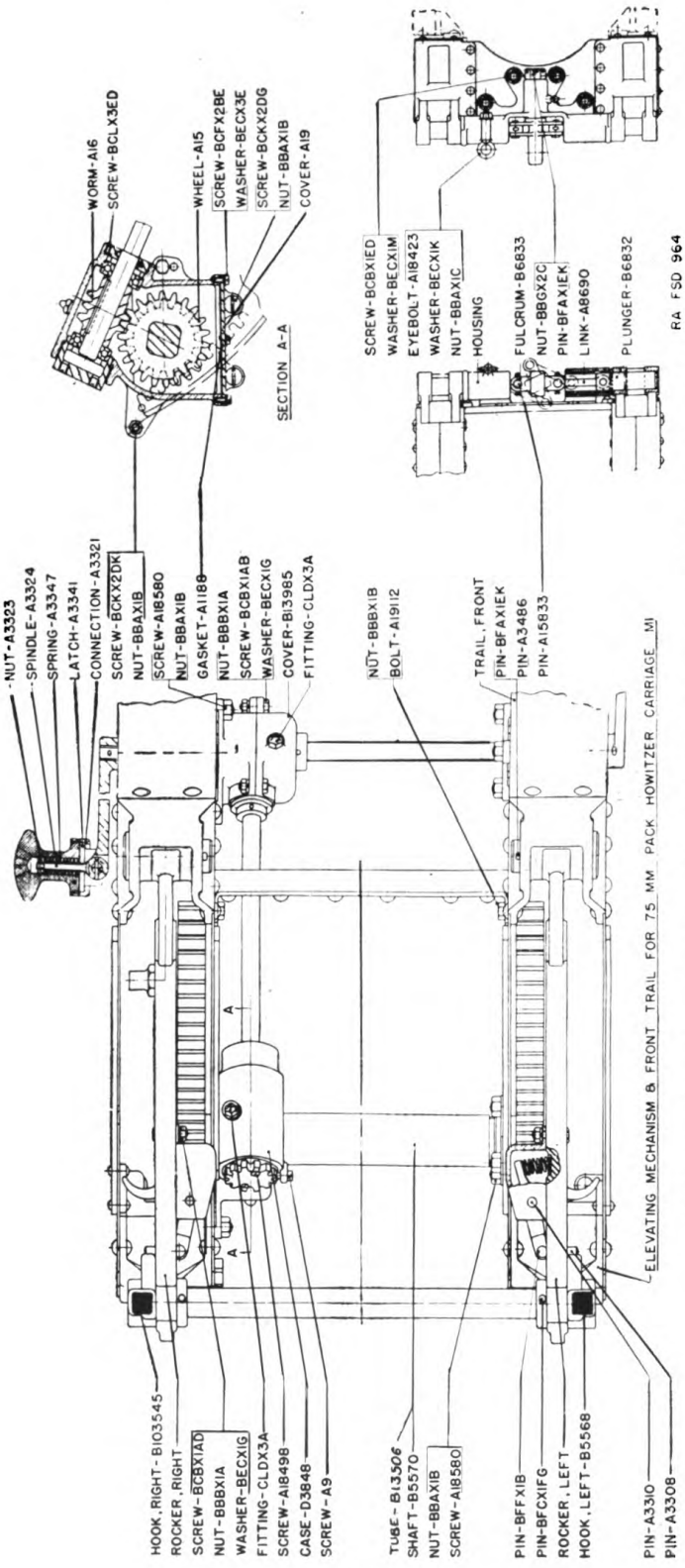


FIGURE 16.—Elevating mechanism and front trail, assembly (75-mm pack howitzer carriage, M1).

Reference	*Item*
A19112	Bolt, hex-hd., S., 5/16–24NF–2 by 9/16.
D3848	Case, gear, elevating, upper.
A3321	Connection, crank knob.
B12985	Cover, elevating gear case, lower.
A19	Cover, elevating gear case, upper.
A18423	Eyebolt, trail connecting mechanism housing.
CLDX3A	Fitting, lubr., push type, stght., 1/8–27NPT, male, short.
B6833	Fulcrum, trail.
A1188	Gasket, elevating lower gear case cover.
B5568	Hook, trunnion, L. H.
B103545	Hook trunnion, R. H.
C5797	Housing.
A3341	Latch, elevating crank knob.
A8690	Link, trail fulcrum.
A3323	Nut, crank spindle.
BBBX1A	Nut, reg., hex., s-fin., 1/4–28NF–2.
BBAX1B	Nut, reg., hex., s-fin., 5/16–18NC–2.
BBAX1C	Nut, reg., hex., s-fin., 3/8–16NC–2.
BBGX2C	Nut, slotted, s-fin., 3/4–10NC–2.
BFAX1EK	Pin, cotter, split, S., 5/32 by 1 1/2.
BFFX1B	Pin, rod end, 1/4 in. diam.
BFCX1FG	Pin, taper, No. 4 (.25) by 2.
A15833	Pin, trail fulcrum.
A3486	Pin, trunnion.
A3308	Pin, trunnion hook latch.
A3310	Pin, trunnion hook latch lever.
B6832	Plunger, trail fulcrum.
D2078	Rocker, left.
D2079	Rocker, right.
BCBX1AB	Screw, cap, hex-hd., 1/4–28NF–2 by 7/8.
BCBX1AD	Screw, cap, hex-hd., 1/4–28NF–2 by 1 1/4.
A18580	Screw, cap, hex-hd., S., 5/16–18NC–2 by 3/4.
BCBX1ED	Screw, cap, hex-hd., 1/2–20NF–2 by 1 1/4.
A18498	Screw, hdls., S., 5/16–24NF–2 by 5/16.
A9	Screw, locking, bearing retainer.
BCLX3ED	Screw, mach., fl-hd., cor-res-S., No. 8 (0.164)–36NF–3 by 1/4
BCKX2DG	Screw, mach., fl-hd., S., 5/16–18NC–2 by 3/4.
BCKX2DK	Screw, mach., fl-hd., S., 5/16–18NC–2 by 1.
BCFX2BE	Screw, mach., oval-fil-hd., S., No. 10 (0.190)–24NC–2 by 7/16.
B5570	Shaft, rocker pinion.
A3324	Spindle, crank.
A3347	Spring, compression, 0.063 diam. stock, .53 O. D., 10 coils.
BECX3E	Washer, lock, hv., No. 10 (0.190) by 1/16 by 1/16.
BECX1G	Washer, lock, reg., 1/4 by 3/32 by 1/16.
BECX1K	Washer, lock, reg., 3/8 by 1/8 by 3/32.
BECX1M	Washer, lock, reg., 1/2 by 1 1/64 by 1/8.
A15	Wheel, elevating worm.
A16	Worm, elevating.

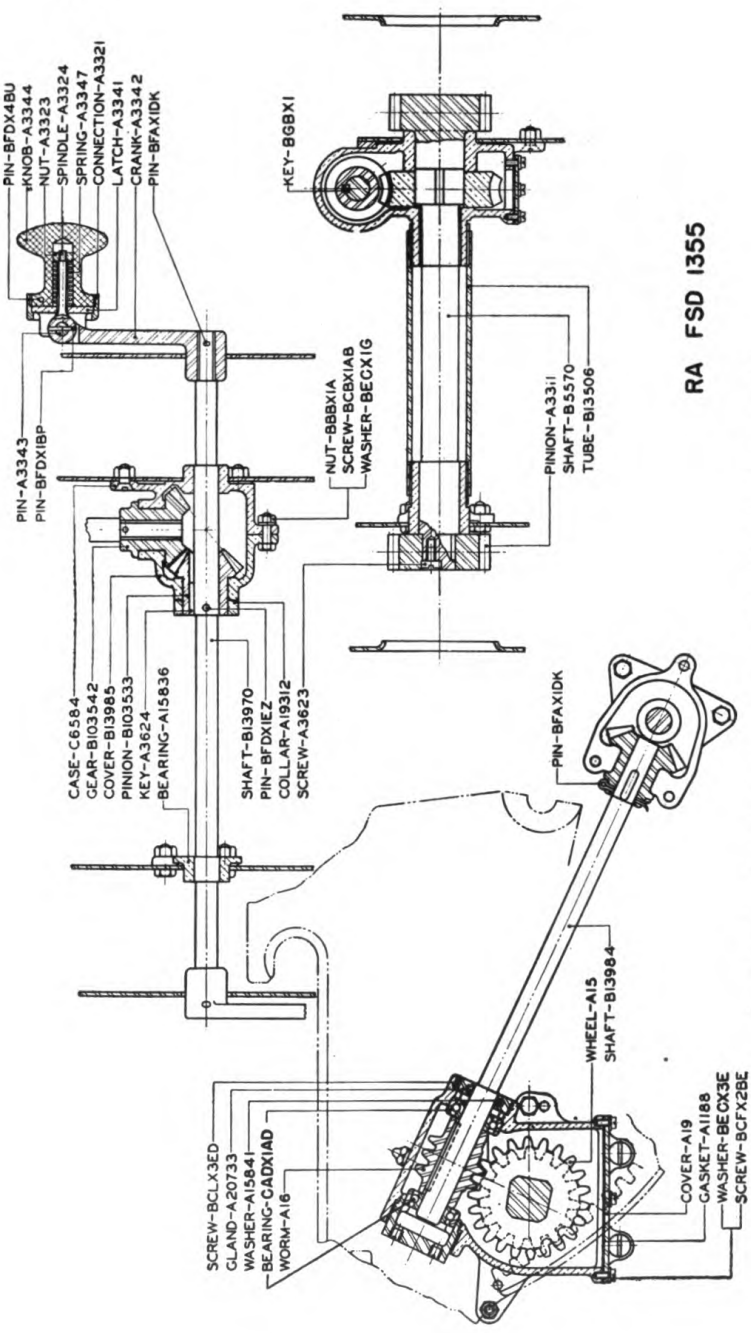
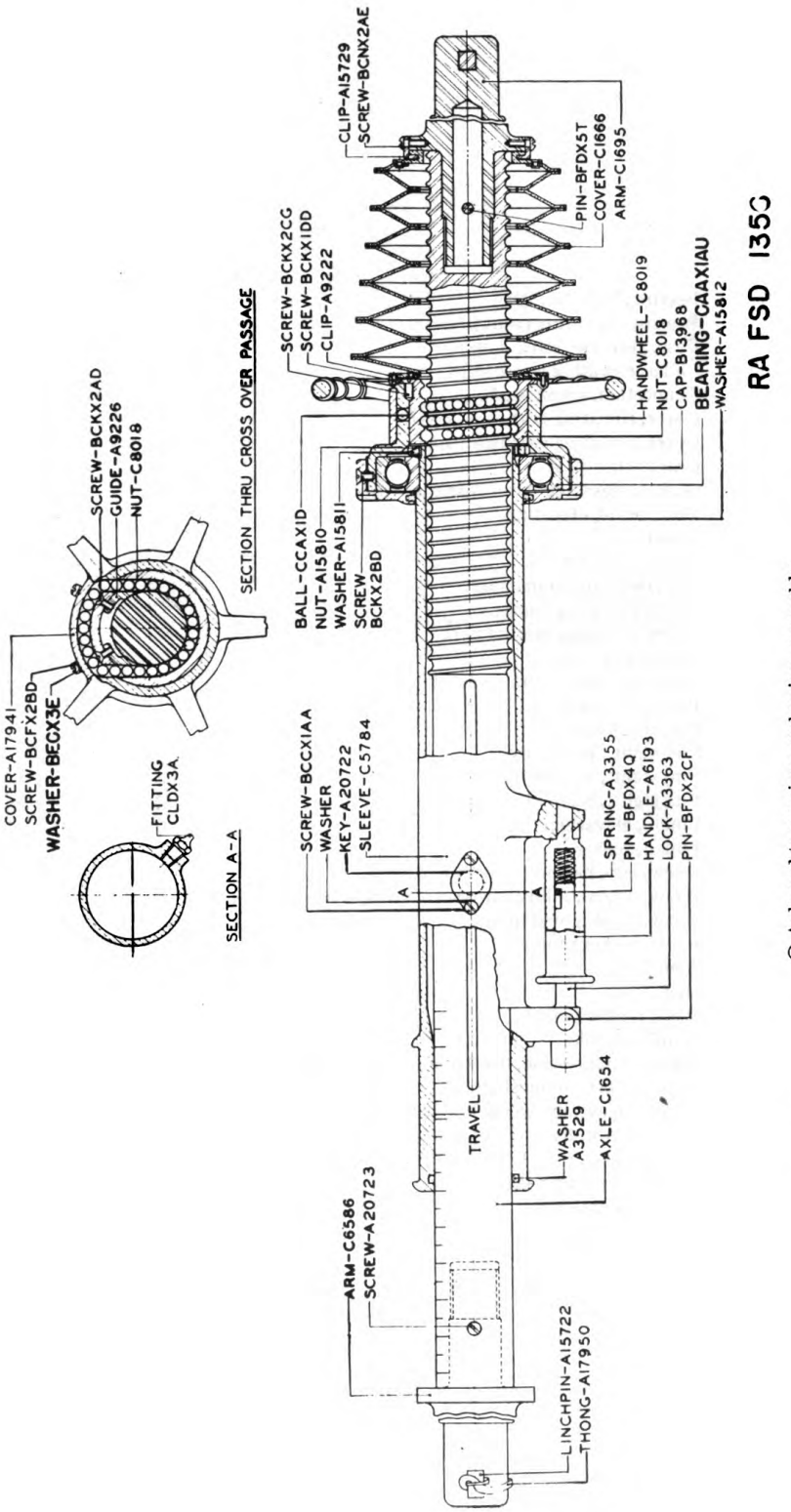


FIGURE 17.—Elevating mechanism (75-mm pack howitzer carriage, M1).

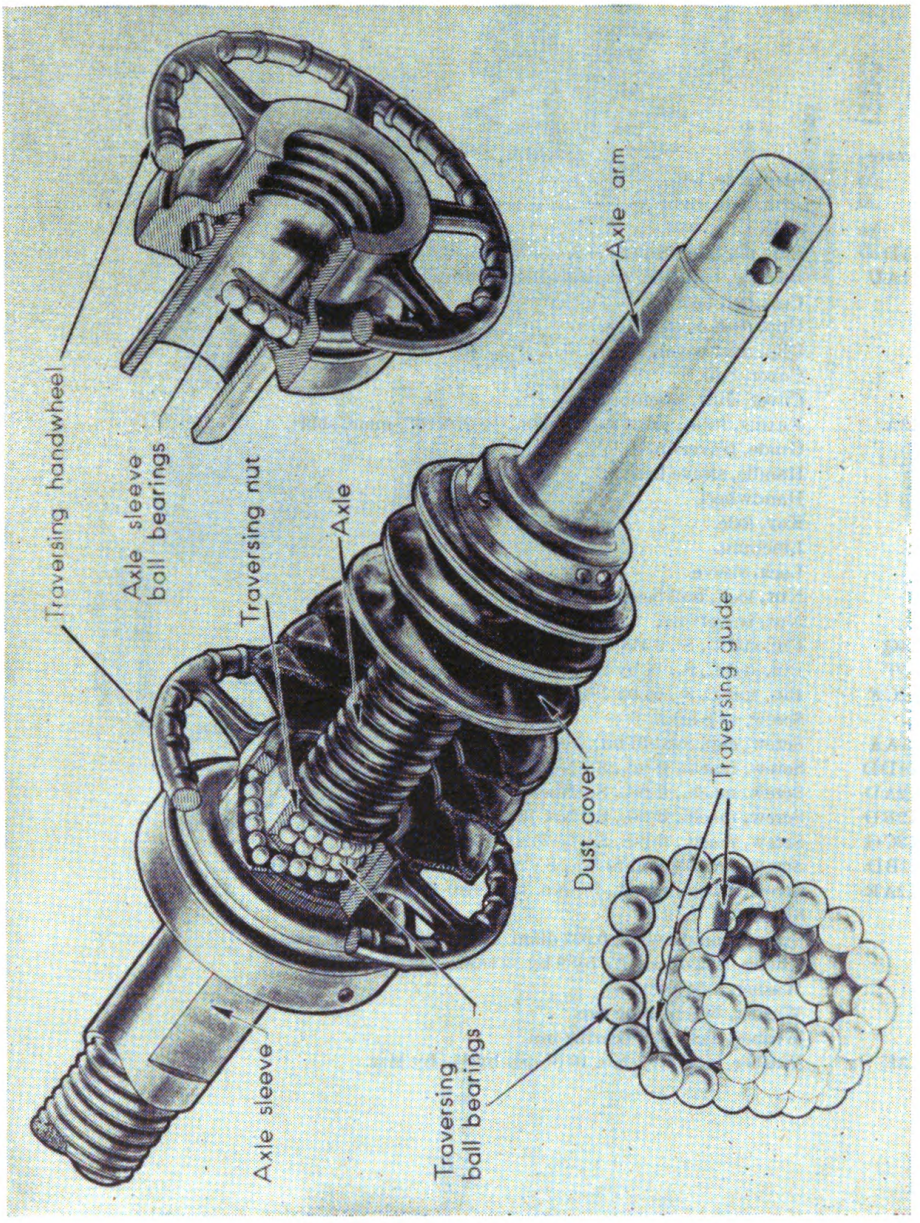
Reference	*Item*
CADX1AD	Bearing, ball, No. 7203.
A15836	Bearing, elevating crank shaft.
C6584	Case, gear, elevating, lower.
A19312	Collar, elevating crank shaft.
A3321	Connection, crank knob.
B13985	Cover, elevating gear case, lower.
A19	Cover, elevating gear case, upper.
A3342	Crank, elevating.
A1188	Gasket, elevating lower gear case cover.
B103542	Gear, bevel, elevating.
A20733	Gland.
BGBX1	Key, 3/16 sq. by 1 7/8.
A3624	Key, elevating crank shaft.
A3344	Knob, elevating crank.
A3341	Latch, elevating crank knob.
A3323	Nut, crank spindle.
BBBX1A	Nut, reg., hex., s-fin., 1/4–28NF–2.
BFAX1DK	Pin, cotter, split, S., 1/8 by 1 1/2.
A3343	Pin, crank spindle.
BFDX1BP	Pin, stght., S., 3/32 by 7/8.
BFDX4BU	Pin, stght., S., .118 by 1 3/4.
BFDX1EZ	Pin, stght., S., 3/16 by 1 3/4.
B103533	Pinion, elevating.
A3311	Pinion, rocker.
BCBX1AB	Screw, cap, hex-hd., 1/4–28NF–2 by 7/8.
BCLX3ED	Screw, mach., fl-hd., cor-res-S., No. 8 (0.164)–36NF–3 by 1/4.
BCFX2BE	Screw, mach., oval-fil-hd., S., No. 10 (0.190)–24NC–2 by 7/16.
A3623	Screw, rocker pinion.
B13970	Shaft.
B13984	Shaft.
B5570	Shaft, rocker pinion.
A3324	Spindle, crank.
A3347	Spring, compression, 0.063 diam. stock, .53 O. D., 10 coils.
B13506	Tube, rocker pinion shaft.
A15841	Washer, elevating worm ball bearing gland.
BECX3E	Washer, lock, hv., No. 10 (0.190) by 1/16 by 1/16.
BECX1G	Washer, lock, reg., 1/4 by 3/32 by 1/16.
A15	Wheel, elevating worm.
A16	Worm, elevating.



① Axle and traversing mechanism, assembly.

FIGURE 18.—Axle and traversing mechanism, assembly (75-mm pack howitzer carriage, M1).

Reference	*Item*
C1695	Arm, axle, left.
C6586	Arm, axle, right.
C1654	Axle.
CCAX1D	Ball, chr-alloy-S., grade 2, 5/16-in.
CAAX1AU	Bearing, ball, No. 213 (shown on figure as A15809).
B13968	Cap, ball bearing.
A9222	Clip, dust cover, inner.
A15729	Clip, dust cover, outer.
A17941	Cover, ball.
C1666	Cover, dust, assembly.
CLDX3A	Fitting, lubr., push type, stght., 1/8–27NPT, male, short.
A9226	Guide, traversing.
A6193	Handle, sleeve lock.
C8019	Handwheel.
A20722	Key, axle.
A15722	Linchpin.
A3363	Lock, sleeve.
A15810	Nut, lock, ball bearing, bore 2½.
C8018	Nut, traversing.
BFDX4Q	Pin, stght., S., 0.118 by 1¼.
BFDX5T	Pin, stght., S., ¼ by 2¼.
BFDX2CF	Pin, stght., S., 3/8 by 1¾.
A20723	Screw, axle arm.
BCCX1AA	Screw, cap, oval-fil-hd., ¼–20NC–2 by ¾.
BCKX1DD	Screw, mach., fl-hd., S., No. 5 (0.125)–40NC–2 by 5/16.
BCKX2AD	Screw, mach., fl-hd., S., No. 10 (0.190)–24NC–2 by 7/16.
BCKX2BD	Screw, mach., fl-hd., S., No. 12 (0.216)–24NC–2 by 7/16.
BCKX2CG	Screw, mach., fl-hd., S., ¼–20NC–2 by ¾.
BCFX2BD	Screw, mach., oval-fil-hd., S., No. 10 (0.190)–24NC–2 by ¾.
BCNX2AE	Screw, mach., rd-hd., S., No. 10 (0.190)–24NC–2 by ½.
C5784	Sleeve.
A3355	Spring, compression, 0.062 diam. stock, .484 O. D., 8 coils.
A17950	Thong, latigo lea., 3/16 by 9 by ⅛ thick, both ends slit.
A3529	Washer, axle sleeve.
A15812	Washer, ball bearing cap.
A15811	Washer, lock, ball bearing nut.
BECX3E	Washer, lock, hv., No. 10 (0.190) by 1/16 by 1/16.



② Traversing mechanism.

FIGURE 18.—Axle and traversing mechanism, assembly (75-mm pack howitzer carriage, M1) —Continued.

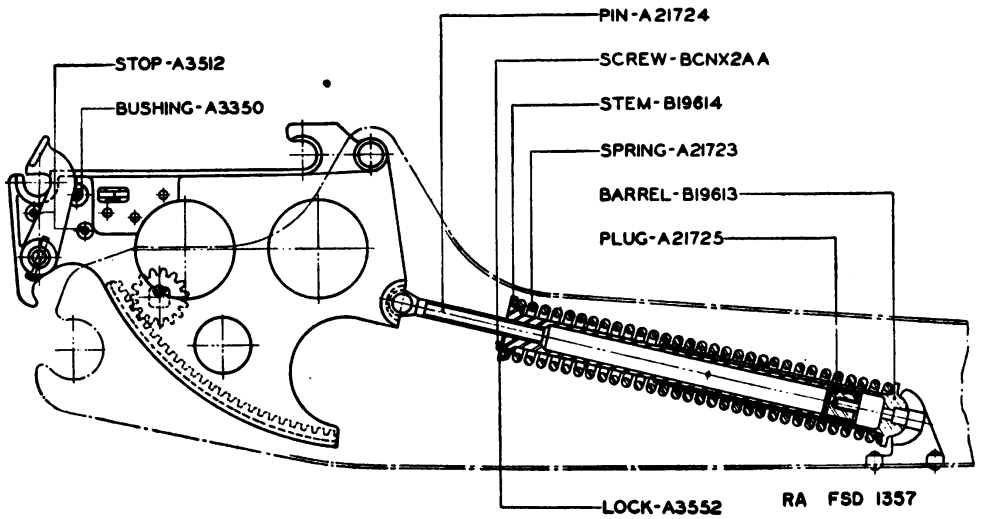


FIGURE 19.—Equilibrator (75-mm pack howitzer carriage, M1).

Reference	*Item*
B19613	Barrel, equilibrator.
A3350	Bushing, rocker.
A3552	Lock, equilibrator pin.
A21724	Pin, equilibrator trunnion.
A21725	Plug, equilibrator stem.
BCNX2AA	Screw, mach., rd-hd., S., No. 10 (0.190)–24NC–2 by ¼.
A21723	Spring, equilibrator compression.
B19614	Stem, equilibrator.
A3512	Stop, trunnion hook.

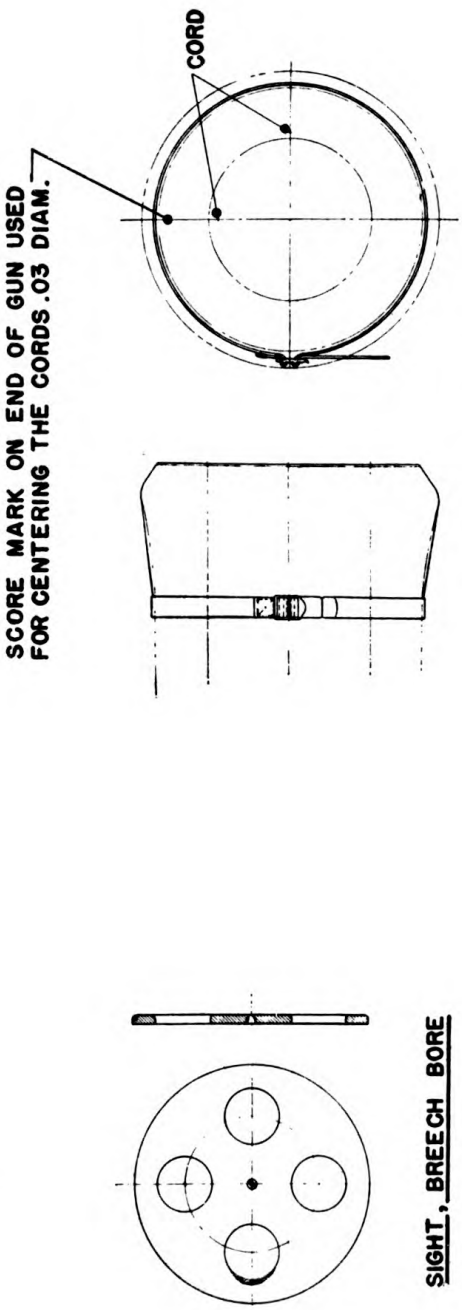
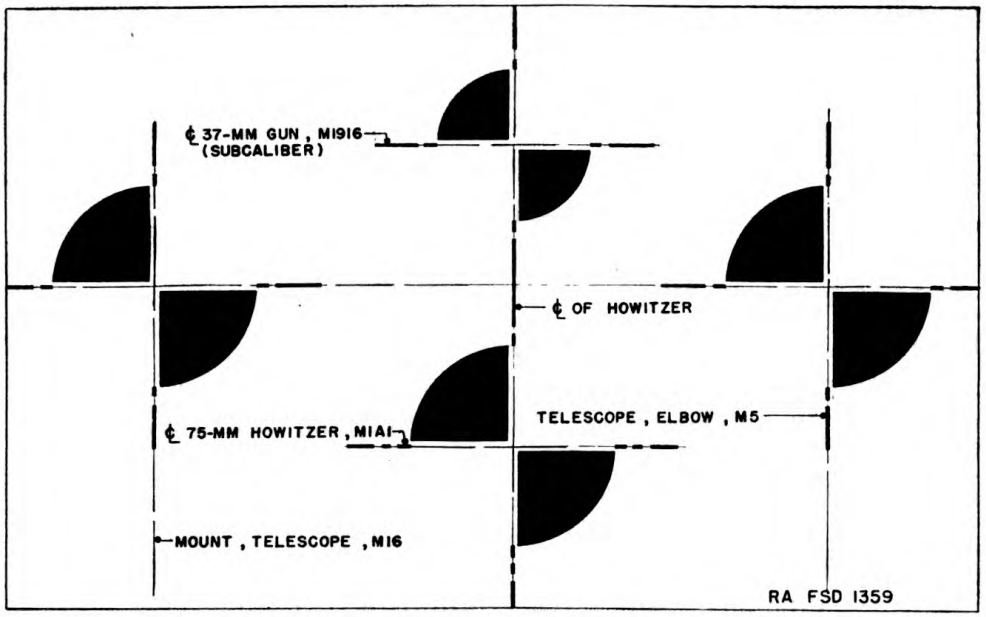


FIGURE 20.—Bore sights.

Reference	*Item*
SPCX2D	Buckle, tgls., 2-bar, 1-in.
SPDX1B	Clip, end, web strap, 1-in.



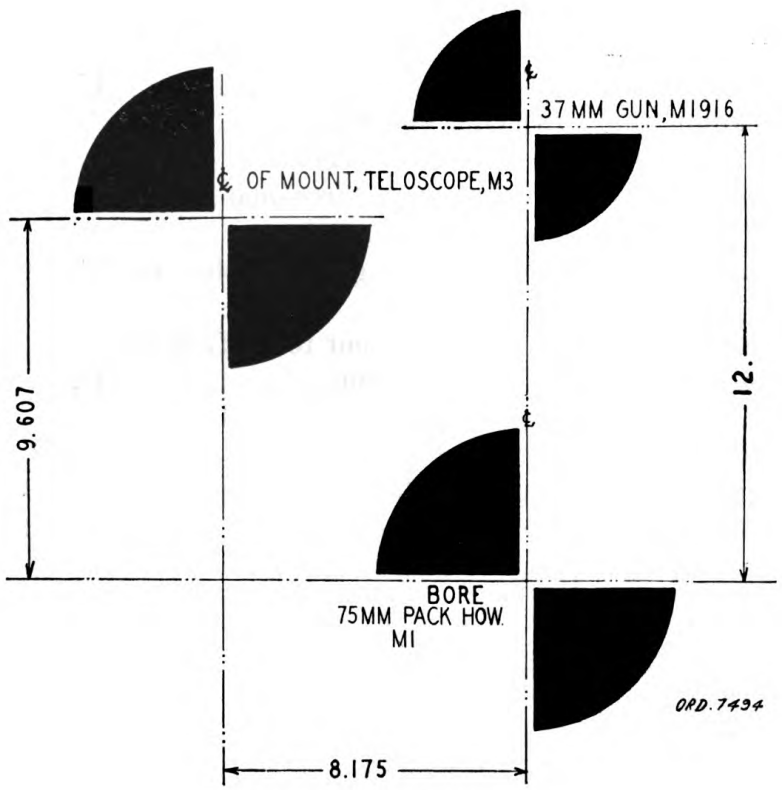


FIGURE 21.—Testing targets.

APPENDIX

LIST OF REFERENCES

1. **Standard Nomenclature Lists.**

Howitzer and carriage, pack, 75-mm, M1	SNL C–20
Howitzer and carriage, 75-mm, M2A1, M3, and M3A1.	SNL C–26
Material, cleaning and preserving, and tools and equipment used therewith.	SNL K–1
Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index."	OPSI

2. **Technical Manuals.**

75-mm howitzer matériel	TM 9–320
Cleaning and preserving materials (Now published as TR 1395–A)	TM 9–850
Ordnance maintenance procedure—matériel—inspection and repair.	TM 9–1100
Star gaging equipment and gutta-percha impressions. (Now published as supplement to SNL N–9)	TM 9–1860
Pressure gage outfits for cannon (Now published as supplement to SNL N–9)	TM 9–1870

3. **Ordnance Field Service Bulletins.**

Maintenance of matériel in hands of troops	OFSB 4–1
Electric and oxyacetylene welding	OFSB 5–2

4. **Ordnance Proof Manual** (proof of guns and carriages).

5. Drawings.

	Class	*Division*
75-mm pack howitzer, M1, and M1A1	52	206
75-mm howitzer carriage, M2A1, and M3	2	265
75-mm howitzer carriage, M3	2	277
75-mm pack howitzer recoil mechanism, M1A2	2	228

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